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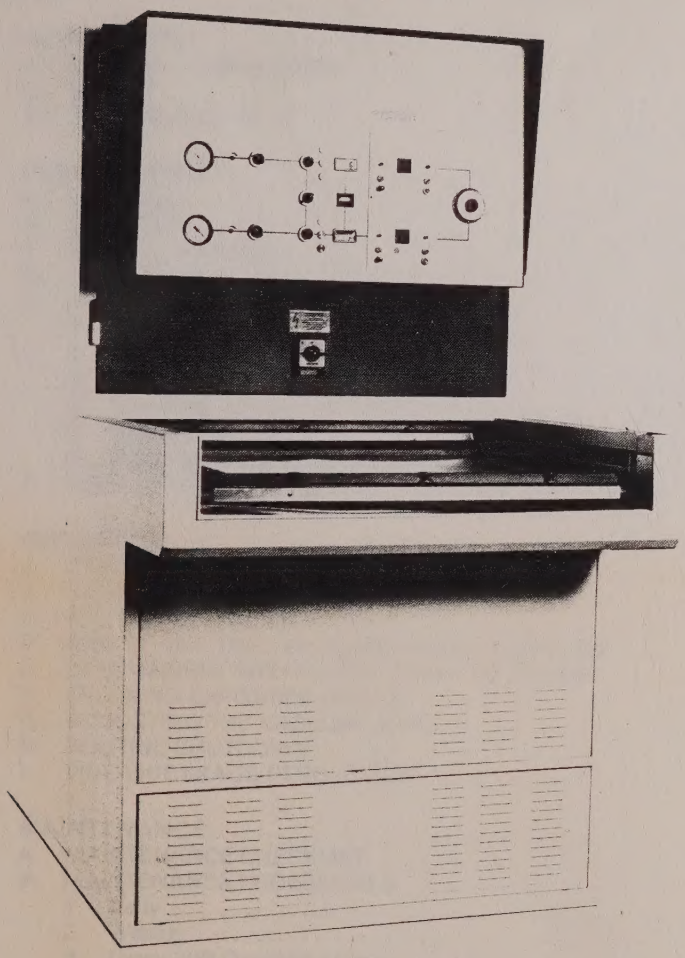

RISTON® PC-130 PRINTER INSTRUCTION MANUAL

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I. INTRODUCTION

A. GENERAL DESCRIPTION

The RISTON® PC-130 Printer exposes RISTON® Photopolymer Film Resists and VACREL® Dry Film Solder Mask to high energy ultraviolet light. The Printer has two exposure lamps and two exposure frames allowing the operator to expose both sides of the panel in one frame while loading the other frame. Separate vacuum pumps for each frame provide rapid vacuum drawdown. Adjusting valves are provided on the control panel for special applications requiring lower vacuum levels. Separate gauges on the control panel indicate the vacuum quality for each frame. The Printer can be operated in two light intensity modes. The 2000-watt low intensity mode gives finer exposure control for resists requiring short exposure times. The 5000-watt high intensity mode gives rapid, accurate exposures for high productivity. The lamps automatically switch to the low intensity mode between exposures to conserve power and extend lamp life. The design of the lamp reflectors provides excellent light uniformity, collimation, and resolution.

Light to the exposure frames is controlled by independently operated shutters on each lamp housing. Exposure times are controlled by light integrators and solid-state photodetectors. This system automatically regulates the exposure times for the resist on each side of each frame to compensate for differences in lamp-to-frame distances and lamp intensity.

The operator selects a number of light units on the integrators for the RISTON® or VACREL® Film to be exposed. When the operator pushes the Start button, the shutters open and the integrators count the number of programmed light units. The shutters close independently of each other, each not closing until the integrator for its lamp counts the preset number of light units.

An auxiliary 0-60 second timer on the control panel allows exposures by time units; both lamp shutters open and close simultaneously.

B. SAFETY

1. PC-130 SAFETY FEATURES

The PC-130 Printer is designed with operator protection in mind. The operator's eyes are protected from any direct light from the exposure lamps by the cabinet and frame design. A main electrical disconnect switch on the control panel turns off all printer functions. The access panels to all electrical components, the exposure lamps, and the vacuum pumps can be opened only with the special key provided to control access to these areas. The side doors on Printer serial numbers 477 and higher have electrical interlocks which turn off the exposure lamps if a door is opened while the Printer is in operation.

2. SAFETY INSTRUCTIONS

In addition to a complete outline of safety precautions and procedures in Section VII, important safety recommendations are interspersed throughout this manual.

A **WARNING** and instructions in bold face type emphasize potential personal safety hazards.

A **CAUTION!** refers to potential equipment damage.

A **NOTE** conveys special information or emphasizes a particular instruction.

C. SPECIFICATIONS

The PC-130 Printer installation involves three separate supplied parts: the Printer, a multi-tap transformer, and a two-speed exhaust blower. The exhaust blower is crated with the Printer; the transformer is shipped in a separate crate.

1. CRATED DIMENSIONS

L x W x H

PC-130	2100 x 1260 x 2210 mm (83 x 50 x 87 in.)
Transformer	640 x 460 x 890 mm (25 x 18 x 35 in.)

2. SHIPPING WEIGHT

PC-130	1014 kg. (2236 lb.)
Transformer	228 kg. (502 lb.)

3. ACTUAL DIMENSIONS

L x W x H

PC-130	1830 x 1066 x 2007 mm (72 x 42 x 79 in.)
Transformer	560 x 330 x 710 mm (22 x 13 x 28 in.)

4. ACTUAL WEIGHT

PC-130	700 kg. (1543 lb.)
Transformer	211 kg. (465 lb.)

5. EFFECTIVE EXPOSURE FRAME AREA

Width	762 mm (30 in.)
Depth	610 mm (24 in.)

6. PC-130 SERVICE SPACE REQUIREMENTS

One meter (three feet) on both sides, no access to the rear of the Printer is required.

7. ELECTRICAL

Printer Input: 380V to 400V, 30 Wye (3 power legs, neutral, and ground); 50 Hz and 60 Hz units are available. A transformer is supplied with the Printer for other supply voltages.

Transformer Input:
(Two transformers are available)

P/N 280003-001 — 190V to 240V and 400V to 480V, 50/60 Hz, 30 Delta (w/ground)

P/N 280003-002 — 346V (312V to 364V), 50 Hz, 30 Delta (w/ground)

A neutral is not required in the supply power to either transformer.

Export Note: Specify the voltage and line frequency (50 Hz or 60 Hz) for the area where the Printer will be used. If a transformer is required, Du Pont will supply one with the unit.

Two-Speed Exhauster: The 380V, 3ϕ power for both speeds of the remote exhaust blower is supplied from the Printer; a separate power supply must not be used.

8. EXHAUST

The two-speed exhaust blower supplied with the Printer **must** be used for proper exposure lamp cooling. The blower is mounted remote from the Printer, usually above a false ceiling. The exhaust air must terminate outdoors.

Exhaust Duct Diameter: 153 mm (6-inch)

Exhaust Air Flow Rates:

	60 Hz Units	50 Hz Units
Low Speed:	380 m^3/hr. (225 cfm)	300 m^3/hr. (177 cfm)
High Speed:	795 m^3/hr. (470 cfm)	600 m^3/hr. (355 cfm)

9. ROOM AIR SUPPLY

Positive pressure should be maintained in the exposure room for cleanliness and to avoid drawing chemical fumes into the Printer.

The lamp cooling air can be optionally drawn from an area outside the exposure room to reduce the load on the ventilation system. An air intake transition piece is supplied with the Printer to adapt the rectangular intake to 200 mm (8-inch) round ducting.

Exposure frame and lamp power pack cooling will put approximately 1.5 kW of heat into the exposure room.

II. INSTALLATION

A. GENERAL

The RISTON® PC-130 Printer is delivered to the user fully insured. The shipment consists of two crates: one contains the Printer and the exhaust blower, and the other contains the power transformer.

NOTE: The PC-130 instruction manual is shipped with the transformer.

It is the user's reponsibility to check for shipping damage at the time of delivery. If a crate is damaged, remove the crate and inspect the contents. If the contents are damaged, submit a claim with the carrier and notify your RISTON® Products Technical Representative.

The user is responsible for the following:

1. Providing Du Pont with specific delivery instructions.
2. Having the necessary equipment and personnel available to unload the delivery truck.
3. Preparing the installation site, including utilities and construction.
4. Moving the Printer components to the installation site and positioning the units.
5. Making all utility connections and interconnections to the Printer, transformer, and exhaust blower.

Although Du Pont does not install the equipment, technical consultation is available. Contact your RISTON® Products Equipment Service Representative or Technical Representative. We strongly recommend that an Equipment Service Representative be scheduled for the initial start-up of the equipment.

B. DELIVERY

In preparing for delivery, the user should determine the following:

1. Is all necessary equipment, such as a forklift, available for unloading and uncrating the equipment?
2. Is there a loading dock and will it accept the equipment from the truck?
3. Have riggers been contacted? (We strongly urge the use of professional riggers).
4. Have clearances been checked and obstructions removed along the route to the installation site?
5. If an elevator is required, does it have the weight capacity and size to accept the Printer?
6. Has an area for uncrating the unit been set aside? It is better to move the unit to the site while crated to prevent damage.

C. INSTALLATION SITE

1. CLEARANCES

Uncrated, the PC-130 Printer is 1830 mm long by 1200 mm wide by 2200 mm high (72 in. x 42 in. x 79 in.); see Figure II-1. The Printer should be placed in a location which allows at least 1 meter (3 ft.) clearance on each side. The Printer may be installed against the wall since access to the rear of the unit is not required.

The transformer should sit on the floor within 3 meters (10 feet) of the Printer.

The exhaust blower should be installed above the Printer. Installing it above a false ceiling will reduce blower noise. (This two-speed blower must be used with the PC-130.)

2. LIGHTING

RISTON® Photopolymer Film Resists and VACREL® Dry Film Solder Masks are sensitive to white light until the development step is completed. Gold fluorescent lighting should be used in the exposure room. Cover all windows, including interior windows into white light areas, with amber-colored plastic sheeting. Light intensity should not exceed 538 lux (50 footcandles).

3. ROOM AIR CONDITIONING

Humidity in the exposure room should not exceed 60 per cent and should be maintained within 15 per cent at all times. High humidity or large variations in humidity can affect the electronics of the Printer and cause exposure variations. The room temperature is not critical but should be maintained within 2°C (5°F), primarily for the dimensional stability of the phototools.

If the exposure lamp cooling air will be drawn from the exposure room, the ventilation system must be sized so that positive pressure is maintained in the exposure room. The exhaust blower for the lamp cooling air consumes 795 m^3/hr. (470 cfm) when operating at high speed during a 5 kW exposure. The blower consumes 380 m^3/hr. (225 cfm) when operating at low speed between 5 kW exposures, or exposing at 2 kW intensity.

NOTE: The preceding airflow rates are for 60 Hz Printers. The flow rates for 50 Hz Printers are 600 m^3/hr. (355 cfm) at high speed, and 300 m^3/hr. (177 cfm) at low speed.

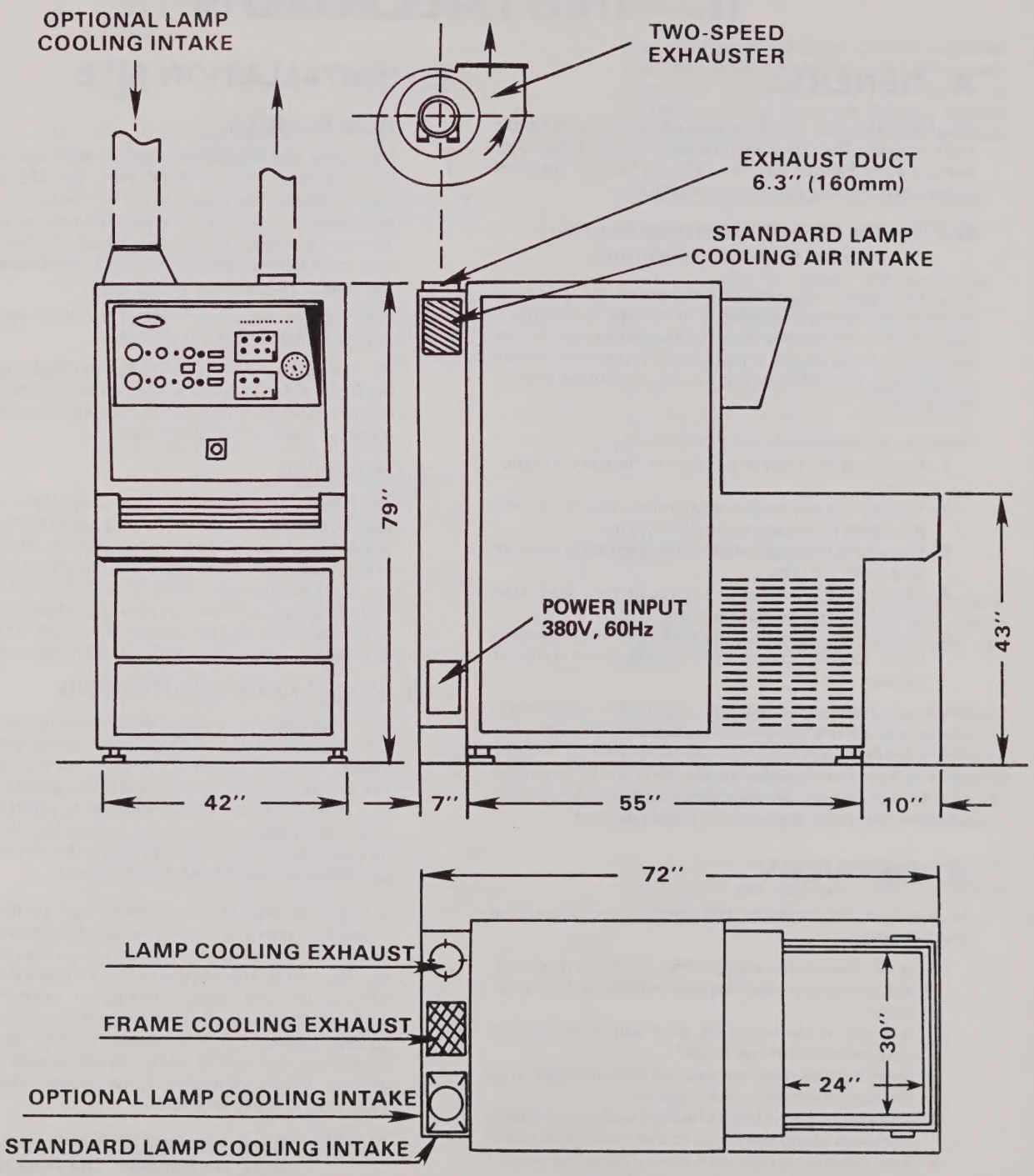


Figure II-1. PC-130 Printer, Installation Connections and Space Requirements

The lamp cooling air can be optionally drawn from an area outside the exposure room; see Section II-E-6.

4. CORROSIVE FUMES

The air used for exposure lamp cooling should never contain corrosive fumes from etchers or other sources, or potentially corrosive fumes, such as chlorinated solvents. Chlorinated solvent fumes, when heated by the exposure lamps, convert into hydrochloric acid vapors and cause corrosion and premature failure of Printer components. Since these solvent fumes are heavier than air, the room air intake for exposure lamp cooling is located near the top of the PC-130 Printer. The exposure lamp housings and their components are constructed of stainless steel to prevent corrosion. If a high concentration of chlorinated solvent fumes are in the exposure room, however, they will be drawn into the Printer through the intake grille and side access doors and corrode the cabinet and shutter mechanisms. If solvent processing equipment or etchers are located in an adjoining room, maintain positive air pressure at all times in the exposure room to prevent fumes from entering. See item C-3 —Room Air Conditioning — for supply air volume requirements.

The lamp cooling air can also be drawn from another area; see Section II-E-6 for the specifications and installation procedures.

D. UNCRATING

1. UNCRATING THE PRINTER

a. Carefully remove the top and sides of the Printer crate.

b. The glass heat shield panels are wrapped in corrugated paper; carefully remove them from the front of the Printer and set them aside.

c. Remove the exhaust blower package from the front of the unit (Figure II-2).

d. Remove all packing material from the Printer and exhaust blower (Figure II-3).

e. Use a forklift to raise the Printer off the crate skid, then slide the skid out from under the unit.

f. Remove the two bottles of vacuum pump oil from the blower, and place the oil on the front of the Printer.

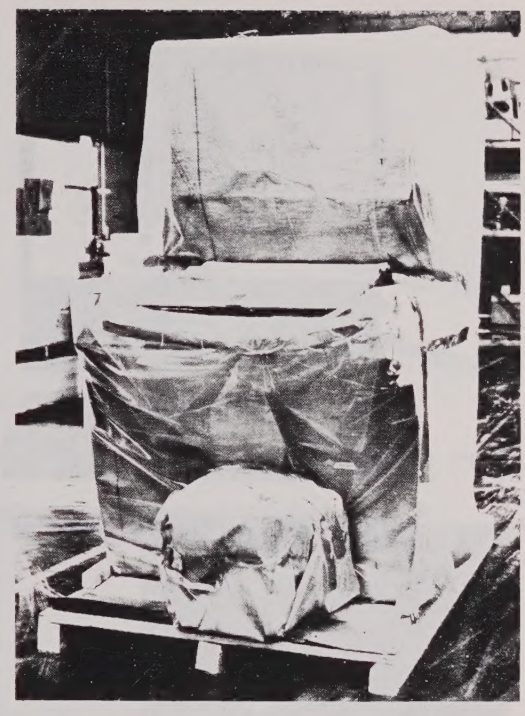


Figure II-2. Printer Crate Removed.

2. UNCRATING THE POWER TRANSFORMER

a. Remove the top and sides of the crate (Figure II-4).

b. Set the PC-130 Printer instruction manual on the front of the Printer and remove the packing material from the transformer.

c. Remove the transformer from its base skid.

d. Place the transformer in position within 3 meters (10 feet) of the Printer.

E. INSTALLATION PROCEDURES

1. SUPPLIED TOOLS AND PARTS

Locate the following items before installing the PC-130 Printer:

a. The bags taped to the front table of the Printer (Figure II-5) contain the following items:

- Two access door keys (for quarter-turn latches)

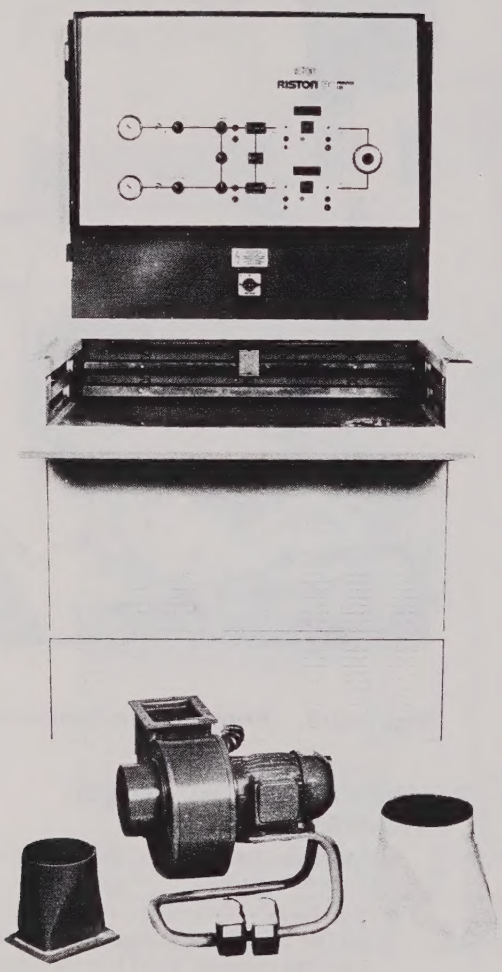


Figure II-3. Printer Crate Unpacked

- Two interlock by-pass keys
- One metric hex key (allen wrench) for the exposure frame retaining screws
- One bag of nuts, bolts, and washers for the exhaust blower installation.

b. Use one of the access door keys supplied to remove the upper panel under the operator's table. The envelope located in the pocket on the back of the power pack access door contains the following items:
   - One adjustment rod for the Printer's leveling feet
   - One metric hex key for the exposure frame retaining screws
   - Spare fuses
   - German electrical schematic.

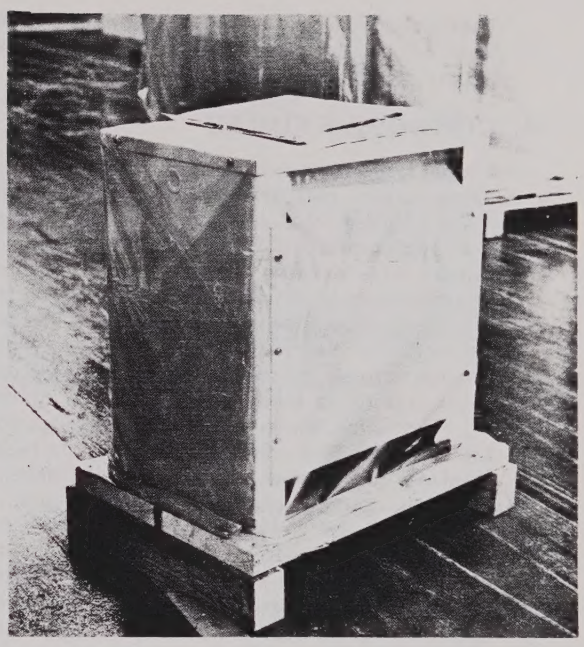


Figure II-4. Transformer Crate Removed (Instruction Manual On Top Cover)

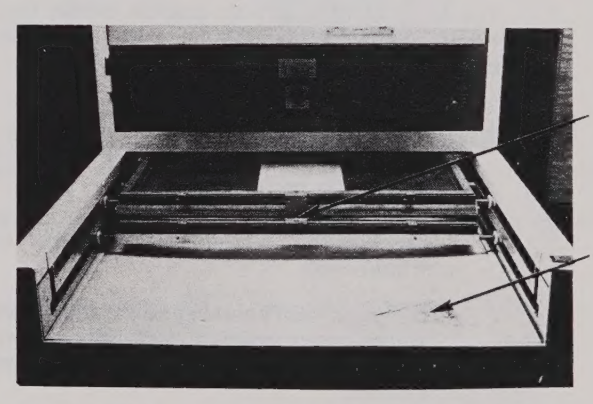


Figure II-5. Printer Tools and Parts (Frames Secured with Shipping Bracket)

c. An air intake transition piece is shipped with the blower (Figure II-3). This can be used to adapt the rectangular lamp cooling air intake opening to a 200 mm (8-inch) round duct system. See item E-6 of these installation procedures.

d. The PC-130 Printer instruction manual and U.S.A. electrical schematic are packed on top of the power transformer.

2. INITIAL SET-UP

The following items should not be done until the Printer is installed in its final position:

a. Remove the packing material from the two sheets of heat protection glass and clean the glass with a non-ammonia cleaner.

b. Use the special key supplied with the Printer to open both side access doors (quarter-turn fasteners). Use the same key to open the two inner access doors on either side of the Printer cabinet. (See Figure II-6.)

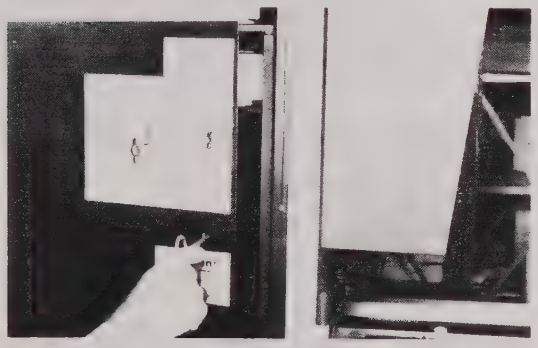


Figure II-6. Opening Inner Access Door

c. Carefully place each sheet of heat protection glass into its frame inside the cabinet (Figure II-7). We recommend having one person on the other side of the cabinet to help support the glass to prevent breakage.

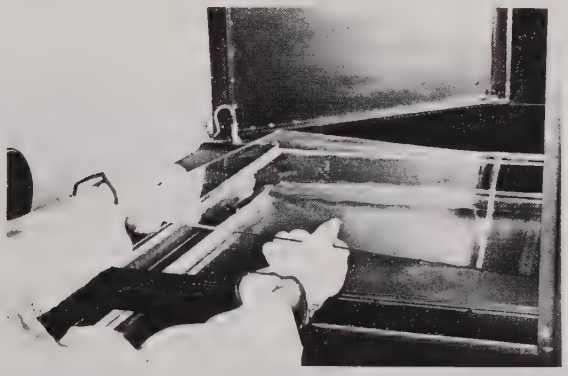


Figure II-7. Installing Heat Shield Glass

d. Loosen the wing nuts securing the transport clamps for the upper and lower lamp housings and shutter assemblies. (See Figure II-8.) Turn the clamps so they will act as stops for normal use and reinstall the wing nuts. (See Figure II-9.)

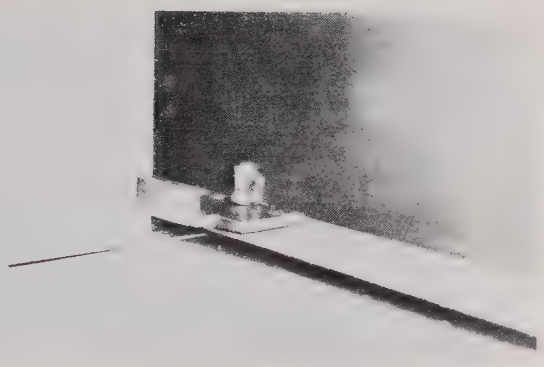


Figure II-8. Lamp Housing Transport Clamp

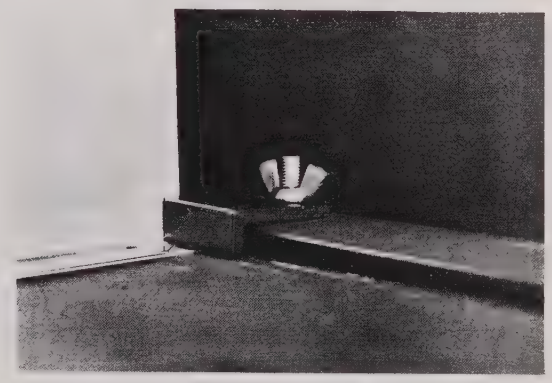


Figure II-9. Transport Clamp Used As Lamp Housing Stop

e. Close and latch the inner and outer access doors.

f. Remove the bracket securing the two exposure frames to each other. (See Figure II-5.) Discard the bracket and screws. Replace the two screws with the two hex socket head screws supplied in the parts bag.

g. Attach the vent hose adapter to the outlet of the exhaust blower using the hardware supplied in the parts bag. (See Figure II-10.) The surplus hardware is to be used with the cable clamps for the blower.

3. LEVELING

The Printer should be level in both front-to-back and side-to-side directions using the top edges of the cabinet for reference. The leveling feet at all four corners of the Printer can be adjusted using the adjustment rod supplied.

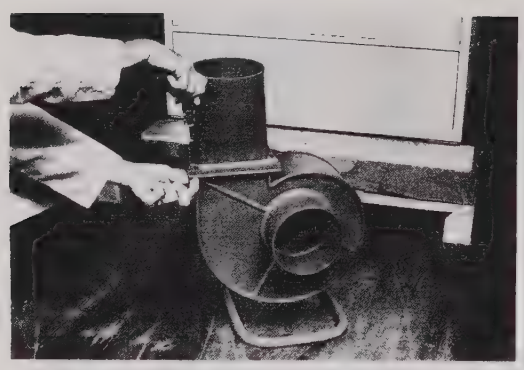


Figure II-10. Installing Blower Vent Duct Adapter

4. ELECTRICAL

The PC-130 Printer operates on 380 V, 3-phase Wye [3 power legs, a neutral, and a ground (earth)]. A multi-tap transformer is supplied with the Printer to convert the user's supply voltage to the range needed. There are three power supply terminals and a ground lug in the transformer for 190 V to 240 V, and for 400 V to 480 V, 50 Hz or 60 Hz power. There is no supply connection for a neutral; the transformer converts the Delta supply connection to the Wye output required for the Printer.

Export Notes:

- Printers must be specially ordered for use with 50 Hz power.
- A special transformer is available for use with nominal 346 V (312 V to 364 V), 50 Hz, 3-phase power. No neutral leg is required in the supply to this transformer.
- The Printer can be operated without a transformer if the power supply includes a neutral leg and is **always** between 380 to 400 V.

A ground (earth) wire must be supplied with the 3-phase supply in all installations. We recommend installing a fused, wall-mounted electrical disconnect box on the incoming power line to the transformer, within sight of the Printer. This will provide a convenient place to lock out the power supply to the transformer and Printer for service.

NOTE: The transformer consumes power whenever it is energized. Turn the power off at the disconnect box when the Printer is shut down.

The wiring to the transformer, the wiring between the transformer and Printer, and the wiring between the Printer and the exhaust blower is the responsibility of the user. Wiring should meet all applicable electrical codes.

a. Fusing

Slow-blow fuses or delay-trip circuit breakers should be used in the incoming power line because of the inrush current when the transformer is energized.

The Printer is rated at 17 KVA; since the load is not balanced across the three power phases, the incoming power should be fused for the high load leg as follows:

SUPPLY VOLTAGE	FUSE SIZE, AMPS/LEG
190	80
200	80
208	80
220	80
240	70
346	50
400	40
420	40
440	30
→ 460	30
480	30

b. Transformer Connections: All Installations

Remove the transformer's top cover. The wiring instruction plate on the inside of the cover details the wiring connections required for various input voltages; also refer to Figures II-11a and II-11b.

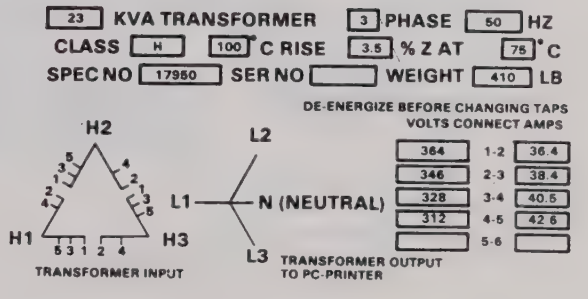


Figure II-11a. Transformer Wiring Instruction Plate (346V, 50Hz Transformer)

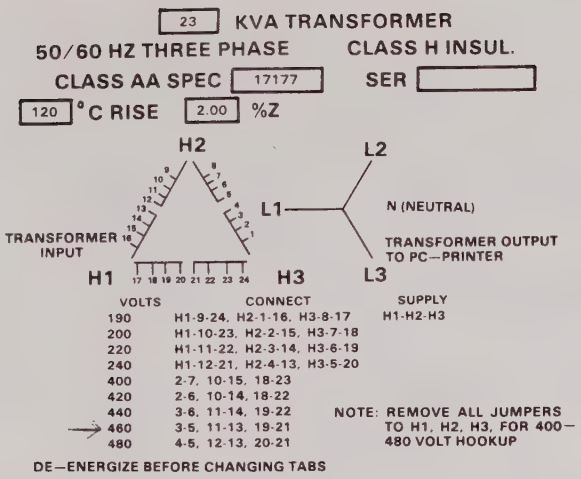


Figure II-11b. Transformer Wiring Instruction Plate (190V - 240V and 400V - 480V Transformer)

Refer to Figure II-12 and connect the input power leads to the open terminals H1, H2, and H3. Connect the ground (earth) lead to the lug on the side of the transformer frame.

c. 190V to 240V & 400V to 480V Transformer (All U.S.A. Models)

The transformer is shipped with wire connections for 190V input (Figure II-12). Refer to the wiring instruction plate and change the wire connections as necessary for your input voltage. If the input power is 400 to 480 volts, no jumper wires are used between H1, H2, and H3 and the numbered terminals (Figure II-13).

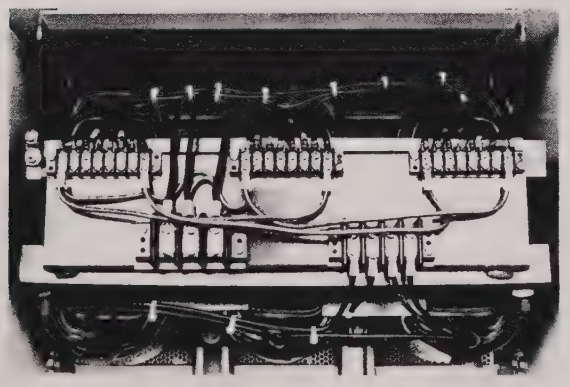


Figure II-12. Typical Transformer Connections for 190V to 240V (190V Shown - As Shipped)

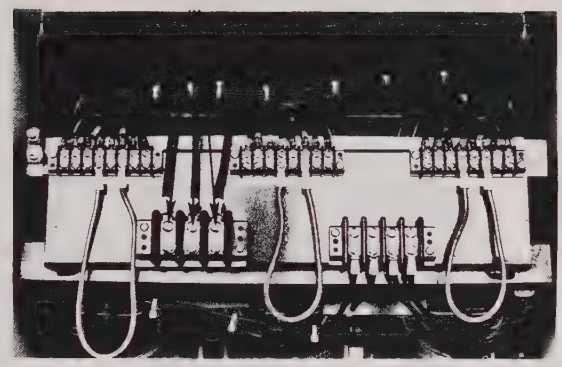


Figure II-13. Typical Transformer Connections for 400V to 480V (460V Connections Shown)

CAUTION! All jumper wires must be disconnected from H1, H2, and H3 if the input power is 400 to 480 volts.

The output terminals of the transformer are labeled L1, L2, L3, and N (neutral). (Some transformers may be labeled R, S, T, and Mp, respectively.) The voltage across all three phases at the output terminals should be between 380 volts and 400 volts. The output voltage to the Printer should never exceed 410 volts. The Printer will operate on input power as low as 370 volts, but an allowance must be made for low voltage periods such as those caused by summer air conditioning loads. Supplying the Printer with 390 volts allows for a five percent (20 volt) drop before any control circuit problems occur.

d. 346V, 50 Hz Transformer

There are four supply voltage taps for 312V, 328V, 346V, and 364V input power. The output terminals of the transformer are labeled R, S, T, and Mp (neutral). The voltage across all three phases at the output terminals should be between 380 and 400 volts.

The Printer will operate on input power as low as 370 volts, but an allowance must be made for low voltage periods. Supplying the Printer with 390 volts allows for a five percent (20 volt) drop before any control circuit problems occur. The output voltage to the Printer should never exceed 410V.

The 346V transformer's output terminals, labeled R, S, T, and Mp connect to terminals L1, L2, L3, and N, respectively, on the Printer's input terminals.

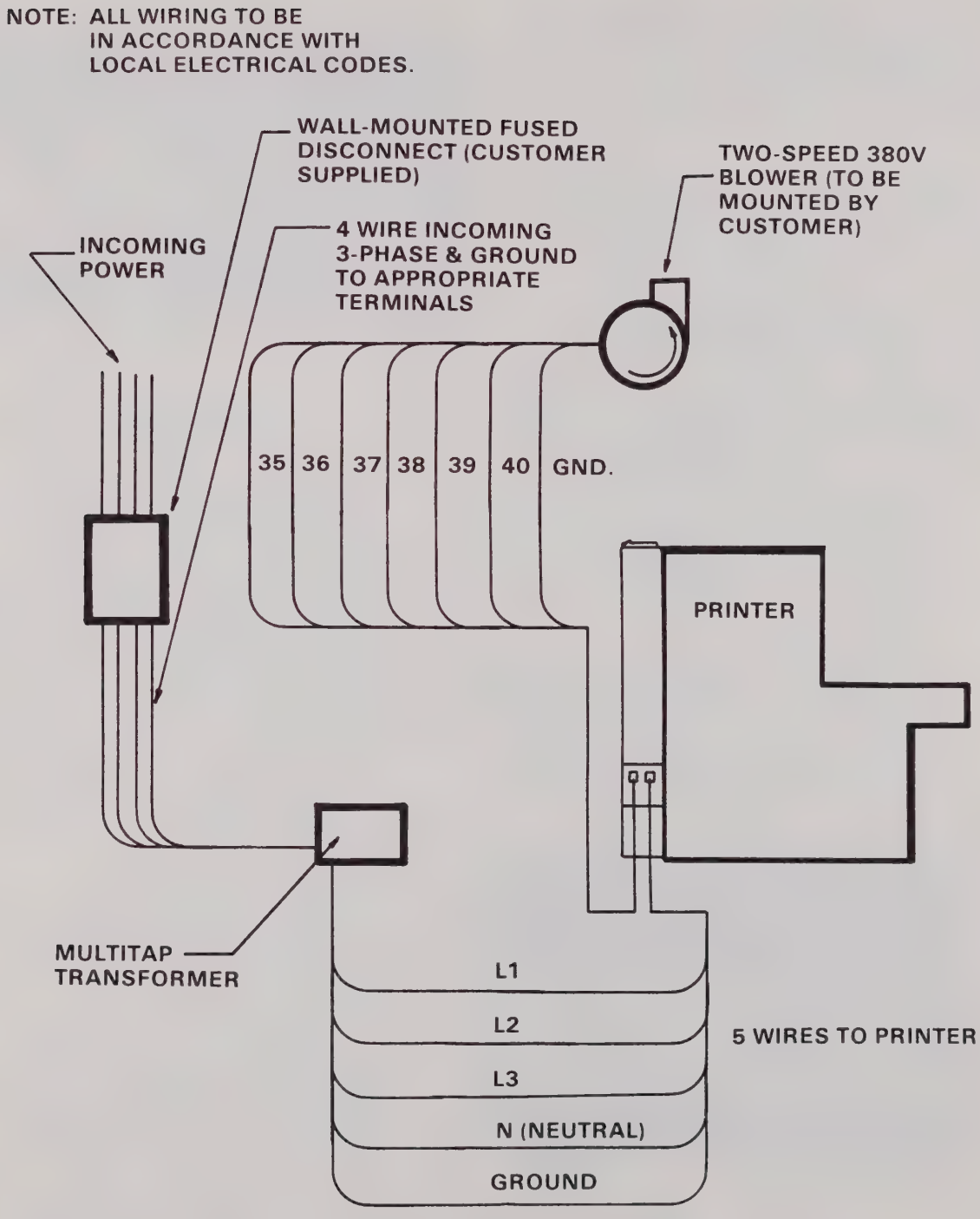


Figure II-14. Printer Installation Wiring Diagram

e. Printer Input Connections

Run the three power leads, the neutral (N), and the ground wire through conduit from the transformer to the right side of the junction box at the left rear of the Printer.

Connect the wires to the labeled terminals on the right-hand terminal strip. Use a screwdriver with the proper size tip to fit the screws and tighten both the upper and lower screws on terminals L1, L2, L3, N, and ground. (See Figure II-15.)

CAUTION! Poor wire contact in the terminal block can cause heat buildup and possible terminal strip failure.

f. Exhaust Blower Connection

The exhaust blower should be mounted on the wall above the Printer or above a false ceiling. It must be interconnected with the PC-130 Printer so the Printer can operate its two-speed motor.

CAUTION! The two-speed blower supplied is required for proper exposure lamp cooling. Do not use any other replacement blower or operate without the blower in the exhaust system.

The blower requires running seven wires (two 380V, 3-phase circuits and a ground) from the junction box at the left rear corner of the Printer to the junction box on the blower motor. (See Figures II-14, II-15, and II-16.)

The wires should be sized for 4 amps per leg. Flexible conduit is recommended for the interconnecting cable.

The blower interconnection terminals in the Printer junction box are numbered from 35 through 40 plus a ground. The wiring instructions on the blower junction box lid identify the six blower terminals. Refer to Figures II-14, II-15, and II-16 and interconnect the Printer and blower as follows:

	Printer Terminal	-To-	Blower Terminal
Low Speed	35		1U
	36		1V
	37		1W
High Speed	38		2U
	39		2V
	40		2W
	Ground		Screw at lower right corner near 2W.

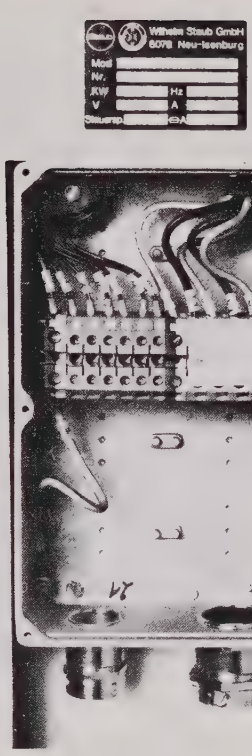
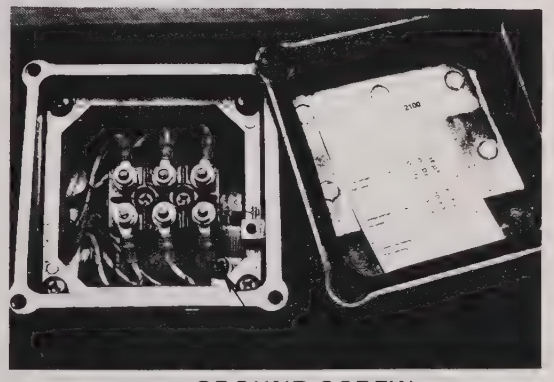


Figure II-15. Printer Junction Box

CAUTION! Do not put a jumper on terminals 1U, 1V, and 1W as shown on the blower junction box wiring instructions for low speed operation.



GROUND SCREW

Figure II-16. Two-Speed Blower Junction Box

g. **Final Check**

The electrical installation of the PC-130 Printer is now complete. Make sure all wiring connections are tight and check the continuity through the interconnection cables for proper terminal connections.

CAUTION! Do not turn on the Printer at this time. Correct blower motor rotation for both speeds will be checked during initial start-up.

5. EXHAUST VENTING

The PC-130 Printer cabinet is separated into three cooling zones.

a. The lamp power packs and the vacuum pumps in the front of the unit are cooled by air convection through the louvers in the cabinet.

b. The exposure frames are cooled by a tangential fan located over the power packs. This fan draws room air through louvers on the sides of the cabinet and blows it across the bottom of the exposure frames inside the cabinet. This air exhausts into the room through the grille at the top rear of the Printer (Figure II-17).

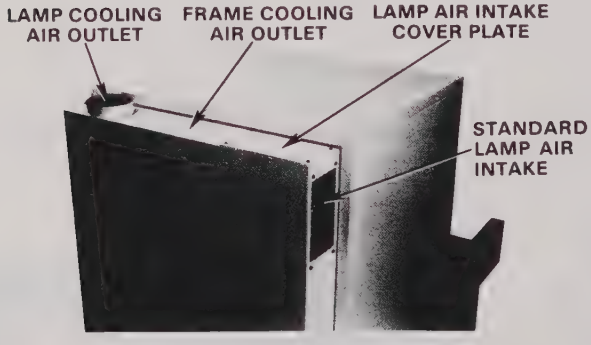


Figure II-17. Printer Air Intake and Exhaust Vents

c. The exposure lamps and the areas between the heat protection glass and the lamp housings are cooled by room air drawn into the top rear corner of the Printer (Figure II-17) by the remote-mounted, two-speed exhaust blower. (See the next item for alternate air intake venting.) The air flows through the upper and lower lamp housings and then through dampers which control the airflow rate. The air is then vented through the blower to the building's exhaust system or outdoors.

Exhaust ducting must be run between the 153-mm (6-in.) outlet at the top rear of the Printer (Figure II-17) and the inlet of the exhaust blower, and from the outlet of the blower to the building's exhaust system or outdoors. This ducting should not restrict the exhaust airflow.

Flexible hose can be used for all exhaust ducting. If rigid ducting is used, a short piece of flexible duct should be used on the inlet and outlet of the blower to minimize noise.

CAUTION! The exhaust air temperature could be as high as 70°C (160°F); be certain that duct materials will tolerate this temperature.

6. ALTERNATE AIR INTAKE FOR LAMP COOLING

The PC-130 Printer normally draws air from the exposure room to cool the exposure lamps. This air is exhausted outdoors or into the building's exhaust system through the two-speed blower supplied with the Printer. Because the temperature and humidity of the supply air for the exposure room are closely controlled, it may be desirable to draw lamp cooling air from another area that is not so closely controlled.

An air intake transition piece is included with the Printer to adapt the alternate lamp cooling air intake opening to a 200-mm (8-in.) round duct system. (See Figure II-18.)

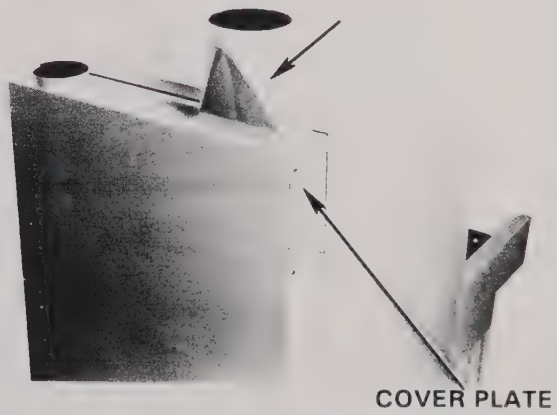


Figure II-18. Alternate Lamp Cooling Air Intake Transition Piece

The intake duct system can then be routed to draw from an adjacent room, hallway, false ceiling area, etc.

The tolerances for lamp cooling air temperature and humidity are very broad. The air temperature should always be between -10°C (13°F) and 65°C (150°F). The relative humidity should always be below 80 percent to avoid condensation and rusting in the Printer cabinet. Corrosive fumes and chlorinated solvent fumes must never be present in the lamp intake air; see Section II-C-4

If air is to be drawn from another area, refer to Figure II-17 and remove the rectangular plate on the top of the left rear corner. Mount this plate over the standard lamp cooling intake grille on the side of the left rear corner. Install the air intake transition piece over the rectangular opening as shown in Figure II-18. Route 200-mm (8-in.) ducting from this air intake to the alternate source. Protect the end of the air intake duct from drawing in rain and coarse debris. If a screen is used on the open end of the intake duct, the **open** area of the screen should be at least equal to the 200-mm (8-in.) duct diameter or 0.31 m^2 (49 $in.^2$).

CAUTION! Do not use filter material anywhere in the lamp cooling air intake duct.

F. INITIAL START-UP

We strongly recommend that the customer schedule a RISTON® Products Equipment Service Representative to be present for start-up. He will check the utility hookups, as well as start-up and adjust the PC-130 Printer for trouble-free operation. There is no charge for this service.

The Service Representative's visit should be scheduled through your RISTON® Products Technical Representative. Please give the Service Representative at least two weeks' notice before the scheduled start-up. Be certain that all previous installation procedures are completed **before** arrival.

NOTE: These initial start-up procedures cover PC-130 serial numbers 477 and higher. Earlier models are very similar but have no side door interlocks, have push-button control switches, and have different pilot lamps on the control panel.

Initial Start-Up Checklist — Power Off

1. Check the installation of the heat protection glass. Both the upper and the lower glass should be positioned properly in the mounting frame. If necessary, clean the glass with a non-ammonia cleaner.

2. Remove the lower lamp housing from the left side of the Printer and set it aside. Remove the upper lamp housing from the Printer, being careful to not strain its power cable. Compress the rubber bellows on the rear of the lamp housings during removal to avoid damaging them (Figure II-19).

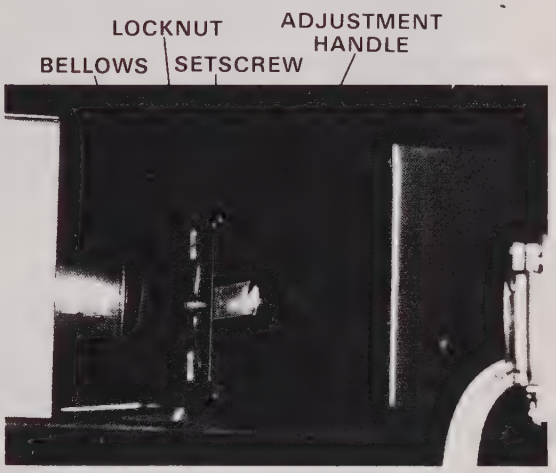


Figure II-19. Lamp Cooling Air Duct (Upper Duct Shown)

3. Refer to Figure II-19 and check the dampers in the upper and lower lamp air ducts:

   a. With the adjustment handle locked in position, reach into the duct and try to move the damper. If it moves, the setscrew behind the handle is loose.

   b. Loosen the locknut and move the handle to the full up position. Reach into the duct and set the damper so it is fully open.

   c. Tighten the setscrew in the collar on the duct side of the adjustment handle.

   d. Reset the handle to the center position and tighten the locknut.

4. Clean the exposure lamps and reflectors with a soft cloth wetted with alcohol (Figure II-20).

5. Remove the tops of both lamp housings and tighten the screws in the ceramic spacers on the lamp mounting brackets (Figure II-21). Replace the tops of the lamp housings.

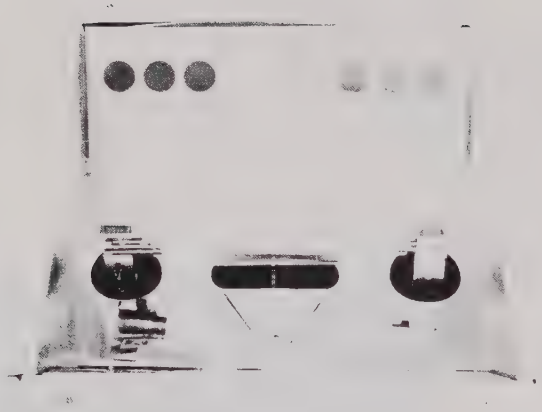


Figure II-20. Lamp Housing Reflector

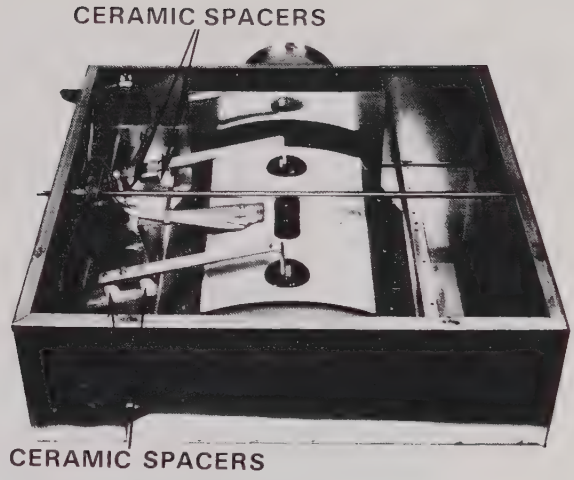


Figure II-21. Lamp Housing Cover Removed

6. Reinstall the upper and lower lamp housings in the Printer. Carefully fit the rubber bellows onto the exhaust connections as the housings are slid into the cabinet to avoid damaging the bellows or restricting the flow of lamp cooling air.

7. Tighten all screw terminal wiring connections in the control panel, lamp power packs, and the main power input junction box.

8. Check the oil level in the vacuum pumps (Figure II-22). The oil must be above the centers of the sight glasses.

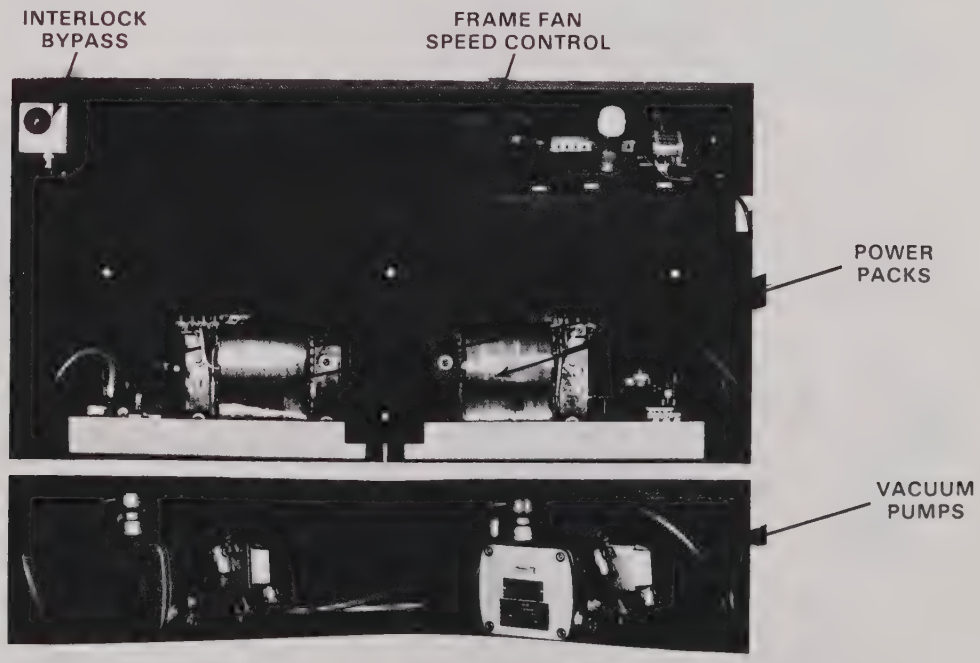


Figure II-22. Front Compartment Panels Removed

9. Check the wiring to the exhaust blower for proper interconnection with the Printer.

10. Inspect the blower venting to be certain that the exhaust terminates in the building's exhaust system or to the outdoors.

11. Check the voltage to the transformer at the customer-installed disconnect box. Check the fuse and wire sizes before energizing the transformer.

12. Remove the top cover of the transformer. Check that the transformer terminals are properly wired for the input voltage per the wiring instruction plate on the top cover. Leave the cover off if proceeding directly to the Power On Checklist.

CAUTION! If the jumper wires have been left on between H1, H2, H3 and the numbered terminals, with input power of 400 to 480 volts, the power supply fuses or circuit breakers will blow when the transformer is energized.

Initial Start-Up Checklist — Power On

1. TRANSFORMER OUTPUT POWER MEASUREMENT

Check that the Printer's main power switch is OFF and turn on the power to the transformer. Check the voltage between all three phases at transformer terminals L1, L2, and L3 (R, S, T on some models). The transformer output voltage should be 380 to 400 volts. It may be necessary to change the transformer terminal connections to obtain the correct output voltage.

WARNING

Disconnect and lock out the power to the transformer before making any wiring changes.

2. PRINTER POWER ON CHECKS

a. Set the vacuum pump switches to the off ("O") position.

b. Turn ON the main power switch on the control panel.

c. Check that the frame cooling fan is operating; there should be airflow out of the center grille at the top rear of the Printer.

d. Turn on the frame illumination table. The switch is located on the underside of the operator's console, directly beneath the exposure start button.

3. VACUUM PUMP ROTATION

a. Turn on both vacuum pumps and push one exposure frame into the vacuum drawdown position. The frame should seal and the vacuum gauge should indicate a value above 80 percent. (Printers installed in areas above 4000 feet altitude may show 10 to 15 percent lower vacuum.) Repeat the vacuum check for the other exposure frame.

b. If the vacuum pumps are operating but the gauges indicate low or no vacuum, the pumps are rotating backwards. Reverse any two phases of the input power to the transformer or the Printer to correct the rotation.

WARNING

Disconnect and lock out the power before making any wiring changes.

4. EXHAUST BLOWER ROTATION

After establishing correct vacuum pump rotation, check the exhaust blower for proper rotation. The rotation in **both** speeds must be checked since separate three-phase power is supplied for each speed.

The exhaust blower wll blow air when running in either direction. The correct rotation is indicated by an arrow on the blower motor. (See Figure II-23.) Correct rotation is necessary for full airflow and proper lamp cooling.

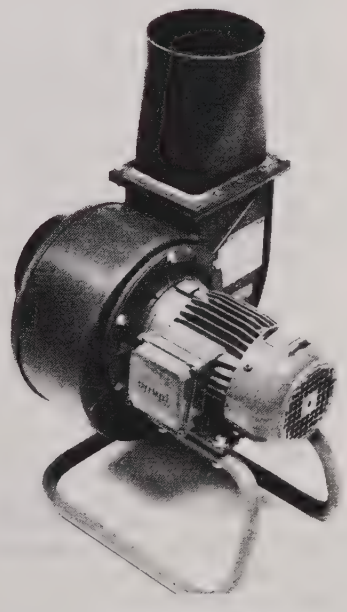


Figure II-23. Two-Speed Exhaust Blower

NOTE: The exposure lamps must be off for this procedure.

a. Refer to Figure II-24, open the control panel and locate relays K7, K8, and K9.

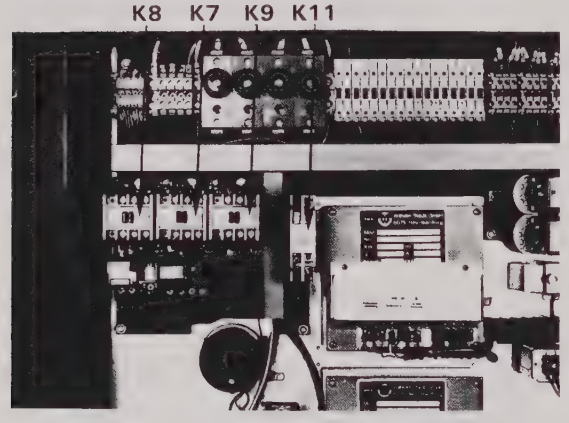


Figure II-24. Exhaust Blower Relays

WARNING

This procedure requires that the power be on. Use extreme caution when operating the relays.

b. Have one person watch the cooling fan on the blower motor to check rotation while another person activates the relays.

c. Momentarily depress the contacts of relay K7 (low speed). You can see the direction of motor rotation as the motor starts and when it slows to a stop.

d. When the motor has completely stopped, momentarily depress the contacts of relays K8 (high speed) and K9 SIMULTANEOUSLY to check the high speed motor rotation.

e. If the rotation is incorrect at low speed, interchange any two of the wires on terminals 35, 36, and 37 in the junction box at the left rear corner of the Printer or on the three **lower** terminals in the blower junction box.

WARNING

Disconnect the power before changing wires.

f. If the rotation is incorrect at high speed, interchange any two of the wires on terminals 38, 39, and 40 in the junction box at the left rear corner of the Printer or on the three **upper** terminals in the blower junction box.

g. Recheck the blower rotation at both speeds to verify correct operation.

CAUTION! If only the contacts of K8 are used to check the high speed blower rotation, the blower will turn in the REVERSE direction from normal operation — use both K8 and K9 to check.

Any component damage caused by failure to follow this procedure will not be covered by warranty.

5. EXPOSURE SYSTEM OPERATION

a. Turn the upper and lower lamp ignition switches to "I" to start both exposure lamps; the ignition switches will retun to the center position when released.

The clear pilot lamps will glow to indicate power to the lamp circuits, the blue pilot lamps will glow to indicate lamp ignition, and the exhaust blower will operate at low speed.

b. Set both integrators to 40 counts.

c. Set the intensity selector switch to 5000 watts exposure intensity.

d. Five minutes after the lamps were ignited the green pilot lamps should glow and the digital display on the integrators should light.

e. Push one exposure frame fully into the Printer cabinet and press the exposure START button on the operator's console. The blower should shift into high speed during the 5000W exposure and return to low speed after both shutters close.

f. Set both integrators to a high number of counts to allow enough time to check the voltage out of the transformer during a 5000W exposure. The power into the Printer should still be in the range of 380 to 400 volts. Change the transformer wiring if necessary to get the output voltage within the recommended range.

g. Check the operation of the manual timer by setting the outer ring to "10" and pushing the center button. Both shutters should open and then simultaneously close in ten seconds.

6. SIDE ACCESS DOOR INTERLOCK AND BYPASS SWITCH

PC-130 Printer serial number 477 and higher are equipped with an electrical interlock system to prevent lamp operation when a side access door is open. The system consists of switches actuated by brackets on the side access doors (Figure II-25) and a key-actuated bypass switch behind the power pack access door (Figure II-26).

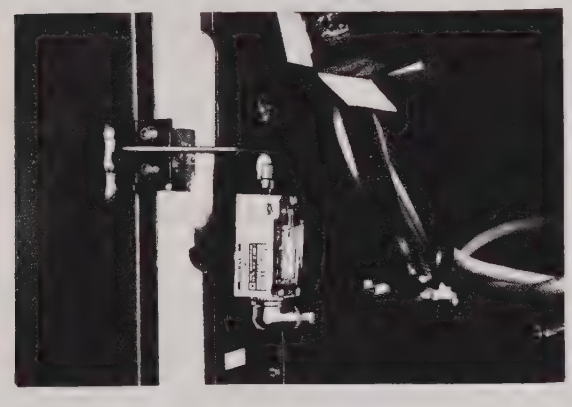


Figure II-25. Door Interlock Switch (S/N 477 & Up)

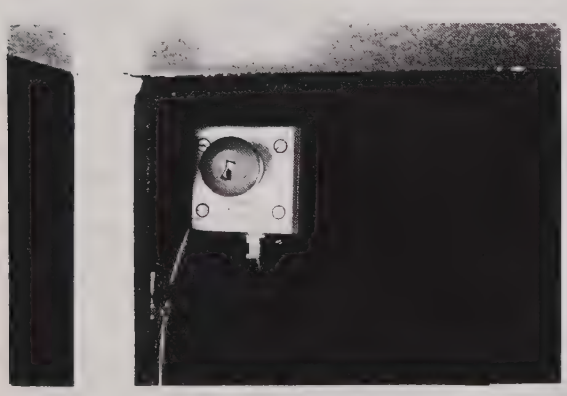


Figure II-26. Door Interlock Bypass Switch (S/N 477 & Up)

If a side door is opened, the interlock switch is actuated and power is cut off to both lamp circuits. The interlock can be bypassed for service by unlocking and releasing the bypass switch.

The bypass switch must be pushed in and the key removed in order to replace the power pack access door. (A bumper on the door will push the switch in if the key is removed.) This deactivates the bypass so the side doors must be closed for the lamps to operate.

Check the operation of the interlock system:

a. Remove the power pack access door.

b. Open both side access doors of the Printer cabinet. The exposure lamps as well as the pilot lamps should go off as soon as one side door is opened.

WARNING

Do not open the side access doors during an exposure.

c. Use the interlock bypass key to release the bypass switch (Figure II-26). the mushroom-head actuator should pop out.

d. Turn both lamp ignition switches to "I" to restart the lamps. The clear pilot lamps should glow and the exhaust blower should run at high speed for a few minutes to cool the lamps. When the blower stops, the blue pilot lamps should glow indicating lamp ignition; proceed immediately to the next step.

e. Remove the key and push in the bypass switch. The exposure lamps should again go off

f. Turn off the main power switch, close both side access doors, and replace the power pack access door.

g. Turn on the main power switch and turn both lamp ignition switches to "I" to restart the lamps.

7. FRAME COOLING FAN SPEED ADJUSTMENT

The tangential fan, located above the power packs, blows room air across the bottom of the exposure frames to keep the frame glass cool. The speed control for this fan is located on the fan enclosure in the power pack cabinet (Figure II-22).

The speed adjustment of this fan is not critical; it is normally set three clicks from maximum speed. The general guideline is to use the highest speed that does not generate excessive noise.

8. LAMP COOLING DAMPER ADJUSTMENT

The airflow rate from the exhaust blower affects the lamp operating temperature and performance. This rate is adjustable by opening or

closing the dampers in the air ducts for the upper and lower lamps inside the Printer cabinet. An **accurate** temperature probe is required for this adjustment.

a. Allow the Printer to idle with the lamps at 2kW for **one hour.**

b. Interlock equipped models only: Remove the power pack access door and use the special key to unlock and release the interlock bypass switch.

c. Turn off the integrator power switches and set the manual timer to zero to prevent starting an exposure during the adjustment procedure. Open the right side access door.

WARNING

This procedure requires the side doors to be open with the exposure lamps on. Avoid looking at the light; the intense ultraviolet light can cause serious eye damage.

d. Remove the hole plug on the end of the upper lamp air duct (Figure II-27). Insert the temperature probe approximately 50 mm (2 inches) into the hole.

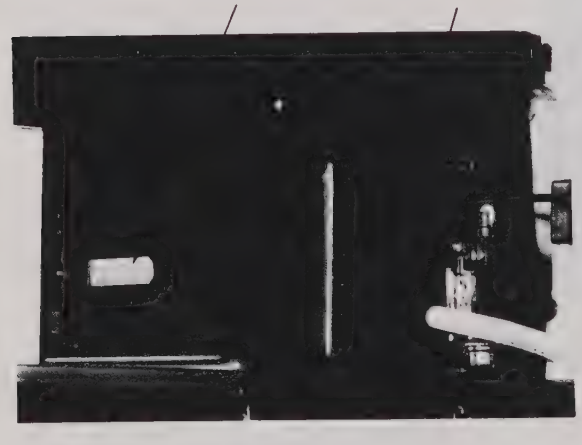


Figure II-27. Upper Lamp Air Duct Test Hole Plug and Damper.

e. The air temperature in the duct should be 55°C to 60°C (131°F to 140°F). Refer to Figure II-27 and adjust the damper as necessary to set the air temperature.

(1) Loosen the lock nut on the damper.

(2) Move the damper about one-quarter inch for each adjustment. (Close the damper to raise the air temperature.)

(3) Wait five minutes after each adjustment before checking the air temperature.

(4) Repeat the adjustment until the air temperature is in the recommended range.

(5) Tighten the damper lock nut.

f. Repeat the damper adjustment procedure for the lower lamp air duct.

9. EXPOSURE BALANCE CHECK

The amount of light energy (intensity x time) striking the resist on each side of each exposure frame should not vary more than 10%. The integrators are calibrated at the factory for balanced exposures, but this must be checked during the initial start-up. See Section V-1 for procedures.

10. VACUUM PUMP OIL CHANGE

Change the oil in the vacuum pumps after all of the initial start-up procedures are completed. Remove the lower access panel on the front of the Printer to service the pumps. The pumps are mounted on a slide-out tray for easier service.

Use the oil supplied in the two square bottles for the initial oil change; fill both pumps completely. See Section IV—Maintenance for the recommended oil change intervals.

CAUTION! Never use vacuum pump oil in these pumps. Use 30-weight, non-detergent motor oil only.

Use extreme caution when sliding the pump service tray back into the Printer cabinet to avoid pinching the wires behind the tray.

THIS COMPLETES THE INITIAL START-UP; THE UNIT IS NOW READY FOR ROUTINE OPERATION. PROCEED TO SECTION III — OPERATION.

III. OPERATION

UPDATED
VERSION

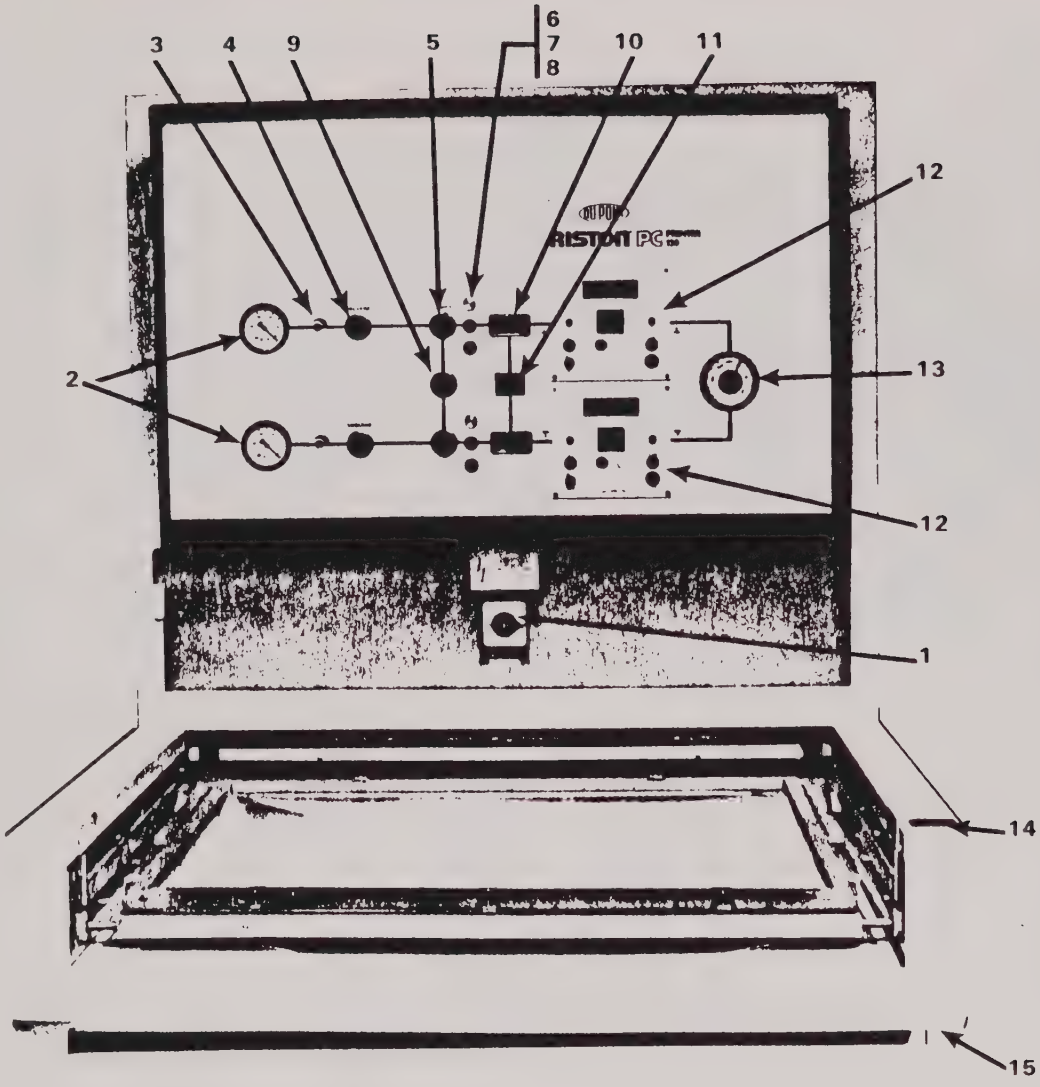


Figure III-1. Control Panel Features and Controls

III. OPERATION

● SAFETY

1. Disconnect and lock out the power before opening any access panels on the Printer.

WARNING

We recommend actually locking out the main power disconnect to prevent others from powering the unit. If this is not possible, tag or tape the main power switch to inform others of the danger. Protect yourself!

2. Do not look into the Printer cabinet while the lamps are on. The intense ultraviolet light can cause serious eye damage.

A. CONTROL PANEL FEATURES AND CONTROLS

Refer to Figures III-1 and III-2 for the location of the operating controls. These controls are numbered from 1 to 14 in the photo and are described in the same sequence below.

1. MAIN POWER SWITCH

Controls the power to all circuits in the Printer and the exhaust blower.

2. VACUUM GAUGES (2)

Indicate percent vacuum in the exposure frames. The upper gauge is for the upper frame; the lower gauge is for the lower frame.

3. VACUUM LEVEL ADJUSTMENTS (2)

Screw adjustments to lower the vacuum level in each exposure frame for special uses. See the comments in Section III-G before making any adjustments.

4. VACUUM SWITCHES (2)

Activate power to the vacuum pumps. The upper switch controls the upper frame pump; the lower switch controls the lower frame pump.

5. LAMP IGNITION SWITCHES (2)

Activate power to the exposure lamp ignition circuits. The upper switch is for the upper lamp; the lower switch is for the lower lamp.

S/N 476 & Lower: Pushbutton switches — These cannot be used to turn off the lamps

S/N 477 & Higher: Twist switches — Turn to "O" to turn off the lamp, turn to "I" to start the lamps.

6. LAMP CIRCUIT PILOT LAMPS (2)

Indicate power to the exposure lamp circuits

S/N 476 & Lower: Pilot lamps illuminate centers of lamp ignition switches

S/N 477 & Higher: Separate clear lens lamps

7. LAMP IGNITION PILOT LAMPS (2)

Each indicates that its exposure lamp is ignited

S/N 476 & Lower: Amber lens

S/N 477 & Higher: Blue lens

8. LAMP READY PILOT LAMPS (2)

(Green lens) Each indicates that its exposure lamp is ready for exposure.

9. LAMP INTENSITY SELECTOR SWITCH

Selects the exposure intensity mode for both lamps.

S/N 476 & Lower:
Pushbutton switch — Lighted when lamps are in 5000-watt mode.

S/N 477 & Higher:
Twist switch — Panel labeled with intensity mode positions.

10. EXPOSURE LAMP HOUR METERS (2)

Indicate total operating hours of the upper and the lower exposure lamps. These meters are not resettable.

11. EXPOSURE COUNTER

Indicates the number of exposures, pushbutton resettable.

12. EXPOSURE CONTROL
LIGHT INTEGRATORS (TWO)

The light integrators automatically adjust the exposure time based on the lamp intensity. The upper integrator is for the upper exposure lamp; the lower integrator is for the lower exposure lamp. There are two circuits in each integrator for separate control of exposures in both exposure frames.

See "B. LIGHT INTEGRATOR FEATURES" for detailed descriptions of the integrator controls.

13. MANUAL EXPOSURE TIMER

Can be used for **timed** exposures up to 60 seconds. The outer ring sets the time period; the center button starts the timed exposure. If both lamps are operating, the shutters on both lamp housings open and close together; the integrator system does not operate during timed exposures.

A timed exposure can be stopped by turning the center button clockwise.

14. EXPOSURE START SWITCH

Starts integrator-controlled exposures for normal operation.

15. FRAME ILLUMINATION SWITCH

Lights the fluorescent lamps under the yellow glass panel to aid in phototool registration.

B. LIGHT INTEGRATOR FEATURES

1. PC-130 PRINTER SERIAL NUMBERS 828 & HIGHER (FIGURE III-2)

These Printers have programmable integrators with the following features:

- Multiprogram Exposures

  Up to nine different count settings of 1 to 9999 units can be programmed into each integrator and changed as needed. These count settings can be calibrated to correspond directly to the millijoules per square centimeter (mJ/cm^2) of light energy at the exposure frame.

- Exposure Start Delay Program

  An exposure start delay of 0.1 seconds to 999.9 seconds can be programmed into each integrator (no decimal point is displayed). This feature is used to allow adequate vacuum drawdown time before exposure, eliminating the need for add-on exposure delay timers. The single setting for this program affects all nine exposure programs.

- UV Check Function

  The "UV Check" button on each integrator opens the appropriate shutter for one minute and, if the integrators have been calibrated in mJ/cm^2, the display shows the approximate light intensity in milliwatts per square centimeter (times ten, since there is no decimal point).

  The UV-Check button can also be used to open the exposure shutters when checking lamp intensity with a radiometer.

The one-minute time period can be terminated with the "Stop" button.

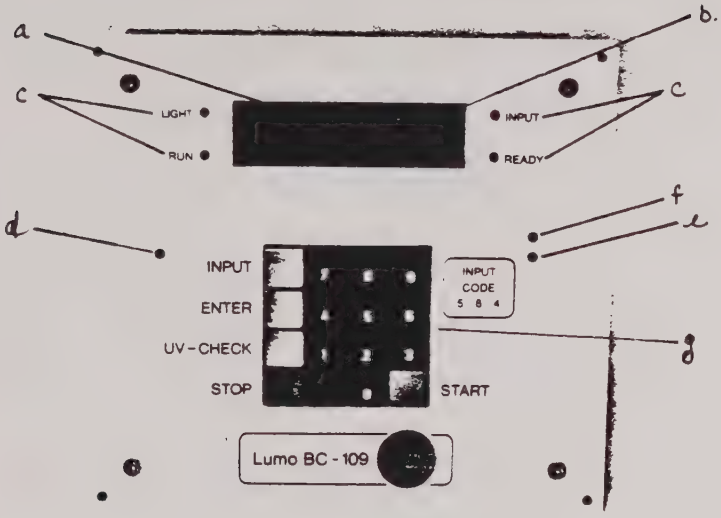


Figure III-2 Programmable Integrator (S/N 828 & Up)

Refer to Figure III-2. The controls and features on the face of each integrator are:

a. PROGRAM CHANNELS

The single-digit number on the left-hand side of the digital display is the program channel.

- CHANNEL 0 is the exposure start delay program for all exposure channels
- CHANNELS 1 to 9 are the exposure programs.

b. PROGRAMMED UNITS

The numbers on the right-hand side of the digital display are the programmed units for the program channel number displayed.

- On CHANNEL 0 (exposure delay), the numbers are time units from 0.1 to 999.9 seconds.

- On CHANNELS 1 to 9, the numbers are light units from 1 to 9999. These should be calibrated in mJ/cm^2; see Section V - Service for calibration procedures.

c. STATUS INDICATORS

- "LIGHT" -- glows when the shutters open and UV light strikes that integrator's photodetector

- "RUN" -- glows when an exposure is in process

- "INPUT" -- glows after the input button is pressed and the input code is used, to show indicate that the program is ready for a new number input.

- "READY" -- glows when the integrator power is on.

d. UPPER FRAME TRIMPOT

A 20-turn pot used to adjust the integrator count rate for balanced exposures on each side of each exposure frame.

e. LOWER FRAME TRIMPOT

A 20-turn pot used to adjust the integrator count rate for balanced exposures on each side of each exposure frame.

f. COARSE TRIMPOT

A 20-turn pot for coarse adjustment of both the upper and lower frame trimpots.

g. CHANNEL SELECTION AND INPUT KEYPAD

- INPUT -- Starts reprogramming sequence
- ENTER -- Enters new program value
- UV-CHECK -- Initiates UV check.
- STOP -- Stops exposure for that integrator. Also acts as a Clear button during programming, clearing last character input.

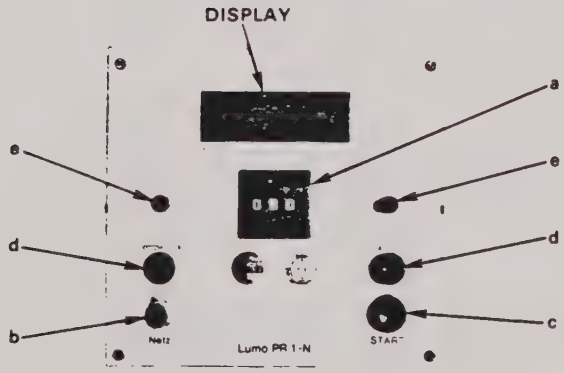


Figure III-3 Non-Programmable Integrator (S/N 827 & Lower)

2. PC-130 PRINTER SERIAL NUMBERS 827 & LOWER (FIGURE III-3)

These Printers have integrators with a single-setting. The digital display shows the operator-selected

number of light units. Refer to Figure III-3; the controls and features of each integrator are:

a. NUMBER SELECTOR DIALS

These are three thumbwheels used to change each display number.

b. ON-OFF SWITCH

This twist switch activates the number display and allows integrator operation when the exposure lamp is operating.

c. START SWITCH

This pushbutton switch can be used to start an exposure using only the exposure lamp that corresponds to the integrator. (e.g. Upper integrator = upper lamp)

d. FUSEHOLDERS (TWO)

These contain fuses for the integrator's control circuits (0.2-amp and 2.0-amp).

e. EXPOSURE CALIBRATION TRIMPOTS (TWO)

These are used to adjust the integrator count rate for balanced exposures on each side of each exposure frame. The left adjustment pot is for the upper frame; the right pot is for the lower frame.

C. ROUTINE START-UP

1. Turn the power on at the wall-mounted disconnect switch

2. Turn on the Printer at the main power switch on the control panel.

3. Turn on the exposure lamps:

   a. Pushbutton Switch Models:

   (1) Push in both lamp ignition switches to turn on the exposure lamps. The center of each switch will light to indicate power to the lamp circuit and the amber pilot lamps will glow when the lamps ignite. After a two to five minute delay period, the green ready pilot lamps will glow and the integrators will turn on. If exposing single-sided boards, turn on the upper lamp only.

   (2) Select the lamp intensity desired by pushing the intensity selector switch. The lamps will expose at 5000 watts when the center of the selector switch is lighted.

   b. Twist Switch Models:

   (1) Turn both lamp ignition switches to "I" to ignite the lamps; the switches will return to the center position when released. The clear pilot lamps will glow to indicate power to the lamp circuits and the blue pilot lamps will glow when the lamps ignite. After a two to five-minute delay period, the green ready lamps will glow and the integrators will turn on. If exposing single-sided boards, turn on the upper lamp only.

   (2) Select the lamp intensity desired by setting the intensity selector switch to 2000 or 5000 watts.

   NOTE: ALL MODELS — If the lamps have recently been turned off, they will not reignite until they have cooled. When the lamp ignition switches are turned on, the blower will run at high speed to cool the lamps, then slow to low speed when the lamps ignite.

4. Select the program or set the number of light units on each integrator that will give the correct exposure for the RISTON® Film being used.

5. Turn on both vacuum pumps if both exposure frames are to be used. If only one frame is to be used, start the pump for that frame only. The center of the pushbutton switches will be lighted when the pump is operating; the twist switches should be set at "I" for the pumps to operate.

D. ROUTINE OPERATION

1. Allow at least 15 minutes between start-up and the first exposure to ensure that the lamps are fully warmed up.

2. Check that the integrator count settings are correct for the job to be run.

   Programmable Integrators:

   a. When the PC-Printer is turned on and the lamps have ignited, each integrator's digital display lights and the yellow "Ready" indicator is lit. The 0 Channel (exposure delay) and its time value is displayed. No exposure can be started while the 0 Channel is displayed.

   b. Press the digit key for the program desired. The channel number and its programmed value will be displayed.

NOTE: If no value is displayed for the 0 or numbered channels, the integrator's memory battery may have failed. The battery should be replaced only by someone experienced in electronics. Refer to Section V - Service in this manual.

3. Turn on the frame illumination lamps.

4. Pull one exposure frame out to the ends of the tracks to release the vacuum. Raise the top half of the frame.

5. Place the panel and phototools in the center of the frame. Bleeder strips may be needed for proper vacuum withdrawal with small panels

CAUTION: Do not wear watches, bracelets, or rings, especially diamond rings, when operating the Printer. Jewelry may scratch the frame glass and cause exposure defects.

6. After registering the panels and phototools, close the top half of the frame and smooth the cover sheet over the panel to minimize air entrapment.

7. Move the exposure frame forward about 25 mm (1 inch) into the vacuum drawdown notch in the frame channel.

8. It may be necessary to squeeze the frame together slightly to seal it. If operating at maximum vacuum level, the vacuum gauge for that frame should register at least 80 percent.

NOTE: We recommend the use of bleeder veins to remove air from the area of the panel to the edge of the vacuum channel. If unembossed MYLAR® Film cover sheets are used, look for "Newton rings" on the panel area as an indication of good contact between the phototool and the panel. Contact your RISTON® Technical Representative for more detailed information.

9. Push the exposure frame completely into the Printer, then push the exposure Start button to begin the exposure.

   The following occurs only on Printers with programmable integrators:

   a. The time setting of the 0 Channel is displayed on each integrator and counts down at a rate of ten counts per second. Then, the value of the selected exposure channel is displayed, the shutters open to begin the exposure, and both integrators count down individually. The channel numbers are not displayed during this sequence.

   b. Each integrator resets to the selected channel after the exposure cycle.

10. If both exposure frames are being used, load a new panel and phototools into the other frame and draw a vacuum on the frame while the first frame is exposing

11. When **both** integrators have finished counting, push the second frame into the Printer to remove the frame just exposed. Pull the exposed frame out to the ends of the tracks to release the vacuum

NOTE: It is normal for the integrators to count down at different rates. This occurs because the light integration system automatically adjusts the exposure time for each frame side based on the light intensity reaching that frame side.

Resist exposure is controlled by a shutter system between the lamps and the frames. The resist will not be overexposed if it is left in the Printer cabinet after the integrators finish counting.

12 Open the top half of the exposure frame and remove the exposed panel and phototools

13. Repeat step Nos. 5 through 12 for each exposure

CAUTION! Do not allow the vacuum frames to rest in the vacuum drawdown position unless the frames are closed and sealed. Turn the vacuum pumps off during breaks in the production and during lunch periods. Running the pumps with no load can damage them. The vacuum gauges should always indicate either "0" or "80%" under normal conditions.

E. ROUTINE SHUTDOWN

All PC-130 Printer functions including the remote exhaust blower can be shut down by simply turning off the main power switch on the control panel.

The vacuum pumps and exposure lamps can be turned off separately by the control panel switches. (The exposure lamps cannot be turned off separately on Printers with pushbutton switches.)

- Do not turn off the Printer or exposure lamps for periods of less than one hour.
- The minimum recommended operating time is four hours per start-up.
- The transformer consumes power when it is energized. If the Printer is shut down for an extended period, turn off the power to the transformer at the disconnect box.

F. CHANGING THE INTEGRATOR PROGRAMS

(Serial numbers 828 & higher only)

1. PROGRAMMING 0 CHANNEL (EXPOSURE START DELAY)

Set the exposure start delay times slightly different (about 0.3 to 0.5 seconds) so the lamp intensity step-up times are staggered. This prevents any accumulation of peak currents and possible fault impulse formation

a. Press 0 on the keypad. The existing time setting for that channel is shown on the right-hand side of the display; "0" appears on the left-hand side. The time setting is in seconds and tenths of a second, although no decimal point is shown. (e.g. a setting of 100 equals 10.0 seconds).

b. The standard input code is 5-8-4 as shown on the face of the integrator. Use the following sequence to change the program setting:

- Press "Input" key.
- Press keys 5, 8, & 4. The Input indicator will glow.
- Press the digit keys for the exposure start delay time in seconds and tenths of a second.
  10.0 seconds = 100
  10.3 seconds = 103.
- Press "Enter" key.

Note: If an error is made in the input, the "Stop" key can be used to clear the last digit key entry.

2. PROGRAMMING CHANNELS 1 TO 9 (EXPOSURE PROGRAMS)

a. Press the key for the program number. The existing count setting for that channel is shown on the right-hand side of the display. The program number appears on the left-hand side.

b. An input code must be used to change the count setting. The standard input code is 5-8-4 as shown on the face of the integrator. Use the following sequence to change the program setting:

- Press "Input" key.
- Press keys 5, 8, & 4. The Input indicator will glow.
- Press the digit keys for the count setting desired.
- Press "Enter" key.

Note: If an error is made in the input, the "Stop" key can be used to clear the last digit key entry.

G. IDENTIFYING THE EXPOSURE FRAME SURFACES

The surfaces of the two exposure frames are often referred to as sides 1, 2, 3, and 4. This method helps you identify which frame the panel was in and which lamp the panel faced.

Side 1 = Top Side of Upper Frame
Side 2 = Bottom Side of Upper Frame
Side 3 = Top Side of Lower Frame
Side 4 = Bottom Side of Lower Frame

H. PC-130 LIGHT INTEGRATION SYSTEM

(ALL MODELS)

The exposure levels of dry film photoresists are dependent on UV light energy which is measured in millijoules per square centimeter (mJ/cm^2). Light energy is a function of the light intensity, measured in milliwatts per square centimeter (mW/cm^2), and the length of the exposure to that intensity (in seconds).

$mW/cm^2 \times \text{time (sec.)} = mJ/cm^2$

Exposure times are automatically controlled by the PC-130 integration system. Photodetectors inside the exposure cabinet measure the light intensity and control the integrator count rate accordingly. For example: as the exposure lamps age, their intensity decreases. The photodetector senses the lower intensity and slows the integrator count rate, automatically lengthening the exposure time for the light energy needed. The operator does not have to change the count setting.

The integrators must be routinely calibrated to ensure that the light energy on each side of each exposure frame does not differ more than 10% from any one side to another. Calibration procedures are given in Section V - Service.

I. DETERMINING INTEGRATOR COUNT SETTINGS AND CHECKING EXPOSURE LEVELS

The operator must determine the integrator count settings needed for proper exposure of the photoresist for each job and each set of phototools. The unit value of the count settings depends on how the integrators were calibrated.

Integrator calibration is done primarily to give equal exposure energy on all four frame sides. In addition, the integrators can be calibrated so the count numbers are equal to the mJ/cm^2 of light energy at the frame. This can be done with phototools or without phototools.

Calibration procedures are provided in Section V - Service. Also read "Using Phototools For Integrator Calibration" in the Service section before deciding on a standard method.

Procedures for the operator to check exposures and determine the integrator count settings are provided in this section for:

1. Integrators Calibrated In mJ/cm^2 (Through phototools or without phototools)
   a. Checking Exposures With A Photoresist Radiometer
   b. Checking Exposures With Density Step Tablets

2. Integrators Calibrated To No Definite Value
   (Checking exposures with density step tablets only)

Find the calibration method used and refer to the appropriate instructions in this section to determine the integrator count settings.

1. INTEGRATORS CALIBRATED IN mJ/cm^2

   Refer to the product data sheet for the photoresist used. Note the recommended ranges for the mJ/cm^2 exposure energy and for density step tablets.

   If Integrators Are Calibrated Through Phototools:

   Set the counts on both integrators within the mJ/cm^2 recommended range.

If Integrators Are Calibrated Without Phototools:

Set the counts on both integrators 10% to 20% higher than the mJ/cm^2 level recommended.

a. Checking Exposure With A Photoresist Radiometer:

1) Place the radiometer probe under a clear area of the phototool to be used for side one. The clear area must be large enough to give a totally unobstructed radiometer measurement.

2) Start a blank exposure with the probe in the center of the exposure frame and measure the mJ/cm^2 energy.

3) Repeat this check for all four frame sides, using the actual phototools that will be used for each frame side.

4) The mJ/cm^2 energy should not differ more than 10% from one side to another. If it does, the phototool densities may be different or the integrators may require calibration. Measure the energy levels on all four sides without phototools to check the calibration. Measure the Dmin density of the clear areas of the phototools to check for uniform densities.

5) Adjust the integrator count settings as necessary to get the recommended mJ/cm^2 level through the phototools.

CAUTION! Both integrators should always be set at the same number. Changing the counts on just one integrator to adjust for one frame side will affect the exposure level of same side of the other frame.

6) Verify the exposure level with a density step tablet to be certain that the photo-resist radiometer was properly calibrated.

b. Checking Exposures With Density Step Tablets:

1) Prepare several sample panels to be used for determining the integrator count settings.

NOTE: Test panels used for checking exposure levels should be considered as important as production panels. Do not use panels that have been laminated and stored for more than three days; do not reuse panels previously laminated and exposed.

2) Place a density step tablet under a clear area of the phototool to be used for side one. Follow the recommended hold time after exposure, then develop the sample panel. Repeat this check for all four frame sides, using the actual phototools to be used for each frame side.

3) The steps held should not differ more than 2 Riston steps (about one Stouffer step) from one side to another. If the difference is greater, the phototool densities may be different or the

integrators may require calibration. If possible, measure the Dmin density of the clear areas of the phototools to check for uniform densities. If the phototools are uniform, recheck the integrator calibration.

4) Readjust the count settings as necessary to get the steps held under the phototools in the recommended range.

CAUTION! Both integrators should always be set at the same number. Changing the counts on just one integrator to adjust for one frame side will affect the exposure level of same side of the other frame.

2. INTEGRATORS CALIBRATED TO NO DEFINITE VALUE

Refer to the product data sheet for the photoresist used. Note the recommended range for density step tablets.

Set both integrators for the number of counts that should give the recommended steps. If this is not known, set them at numbers that give the exposure times shown in the resist data sheet.

a) Prepare several sample panels to be used to determine the integrator count settings.

NOTE: Test panels used for checking exposure levels should be considered as important as production panels. Do not use panels that have been laminated and stored for more than three days; do not reuse panels previously laminated and exposed.

b. Place a density step tablet under a clear area of the phototool to be used for side one. Follow the recommended hold time after exposure and develop the sample panel. Repeat this check for all four frame sides, using the actual phototools to be used for each frame side.

c. The steps held should not be more than 2 Riston steps (about one Stouffer step) from one side to another. If the difference is greater, the phototool densities may be different or the integrators may require calibration. If possible, measure the Dmin density of the clear areas of the phototools to check for uniform densities. If the phototools are uniform, recheck the integrator calibration.

d. Readjust the count settings until the steps held under the phototools are in the recommended range.

CAUTION! Both integrators should always be set at the same number. Changing the counts on just one integrator to adjust for one frame side will affect the exposure level of same side of the other frame.

J. DENSITY STEP TABLETS

RISTON® Products or Stouffer density step tablets can be used for exposure measurements. The Riston Products step tablet is preferred for Riston® photoresists because it permits finer control of exposure levels, allowing better use of the PC-130 Printer's exposure accuracy. In the normal Riston® film exposure range, one Stouffer step equals 3 Riston steps.

K. LAMP INTENSITY VERSUS IMAGE RESOLUTION

The exposure lamps lose intensity with use, increasing the exposure time required for the proper exposure level on the resist. Long exposure times can adversely affect the resolution of circuit images with lines and spaces that are 5-mils or finer. The general recommendation for fine-line patterns is to replace the exposure lamps when the light intensity at the resist is 6 to 7 mW/cm^2. However, by monitoring the light intensity versus the image resolution of your fine-line patterns, you may determine the minimum light intensity for acceptable resist performance.

For less critical exposures, the lamps should be replaced when the light intensity at the resist is 4 mW/cm^2 or when the exposure times become too long for the desired production rate.

For more detailed information on fine-line image resolution, contact your RISTON® Products Technical Representative. Ordering information for light intensity meters can be found under "Component Vendors and Repair Services" in Section VI-Parts.

L. ADJUSTING THE VACUUM LEVEL

The vacuum level in each exposure frame can be adjusted by the bleeder valves on the control panel. This feature is for use when lower than normal vacuum is required for glass phototools or other special uses.

Do not lower the vacuum level unless it is absolutely necessary. The vacuum should never be set below 50% using the bleeder valves. Operating at less than maximum vacuum will increase the maintenance requirements for the vacuum pumps.

NOTE: Vacuum regulator valves can be used to lower the vacuum levels to any level without harming the vacuum pumps. These are not stocked by Du Pont but are available from other vendors; refer to "Component Vendors and Repair Services" in Section VI-Parts.

Use the following procedure to lower the vacuum level with the bleeder valves on the control panel:

1. With the vacuum pumps on, put the exposure frame that is out of the Printer cabinet into the vacuum drawdown position.

2. Seal the frame and wait until the vacuum gauge reaches its maximum level.

3. Use a small screwdriver to adjust the bleeder valve for that frame until the vacuum is at the desired level. (The upper valve is for the upper frame.) Turn the valve counterclockwise to lower the vacuum level.

4. Repeat the procedure for the other frame.

RISTON® PC-130 PRINTER
OPERATION CHECKLIST

1. Clean the heat protection glass and exposure frame glass.
   Inspect the frame vacuum seal for damage.

2. Turn on main power supply to the Printer.

3. Turn on the Printer's main power switch.

4. Turn on the exposure lamps; there is a two-to-five minute warm-up.

5. Select an integrator program or ....
   Set the proper number of counts on both integrators.

6. Start both vacuum pumps.

7. Check the vacuum gauge readings with the frames sealed.
   The gauges should read 80% or higher.

8. Check the exposure levels on both sides of both frames.

III. OPERATION

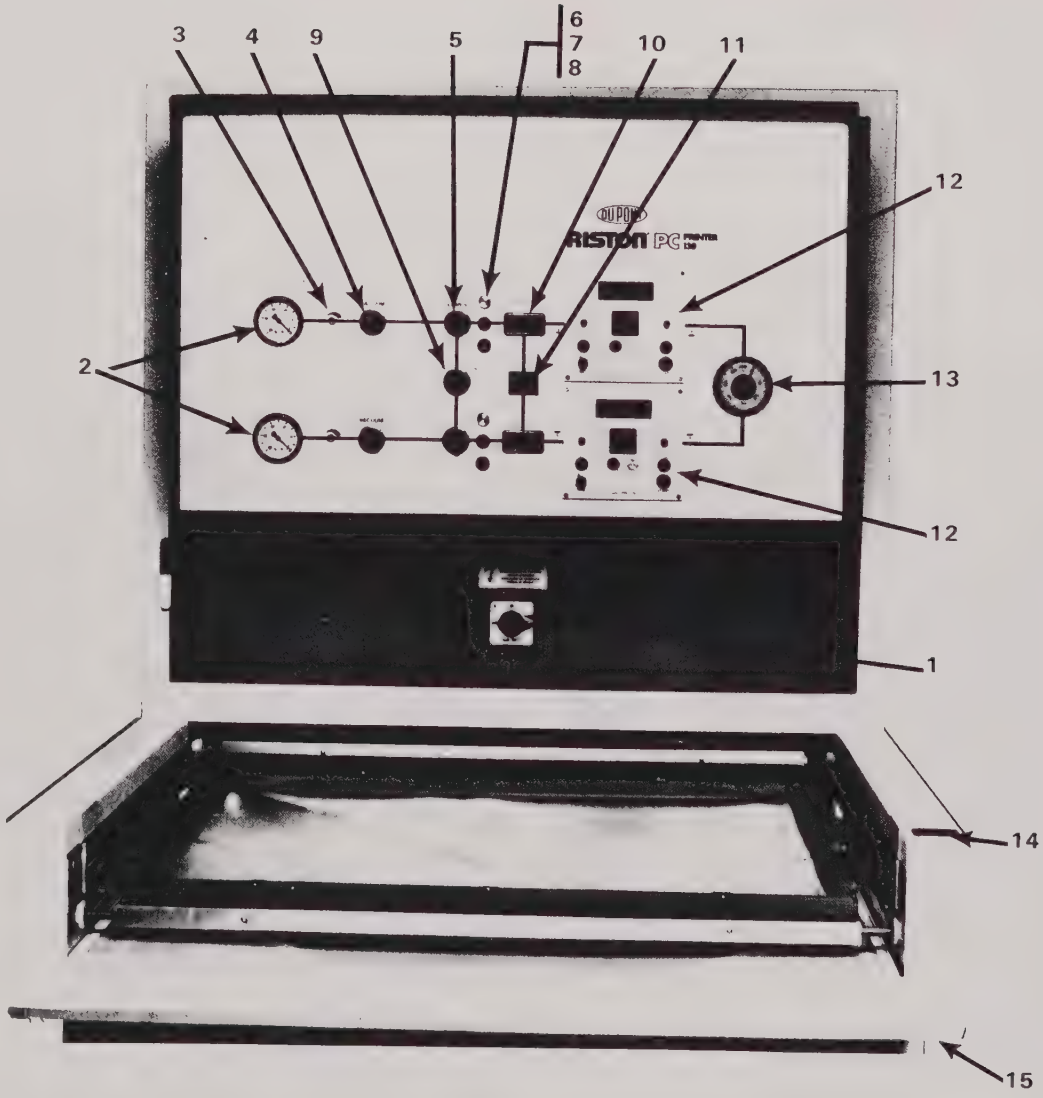


Figure III-1. Control Panel Features and Controls

III. OPERATION

● SAFETY

1. Disconnect and lock out the power before opening any access panels on the Printer.

WARNING

We recommend actually locking out the main power disconnect to prevent others from powering the unit. If this is not possible, tag or tape the main power switch to inform others of the danger. Protect yourself!

2. Do not look into the Printer cabinet while the lamps are on. The intense ultraviolet light can cause serious eye damage.

A. CONTROL PANEL FEATURES AND CONTROLS

Refer to Figures III-1 and III-2 for the location of the operating controls. These controls are numbered from 1 to 14 in the photo and are described in the same sequence below.

1. MAIN POWER SWITCH

Controls the power to all circuits in the Printer and the exhaust blower.

2. VACUUM GAUGES (2)

Indicate percent vacuum in the exposure frames. The upper gauge is for the upper frame; the lower gauge is for the lower frame.

3. VACUUM LEVEL ADJUSTMENTS (2)

Screw adjustments to lower the vacuum level in each exposure frame for special uses. See the comments in Section III-G before making any adjustments.

4. VACUUM SWITCHES (2)

Activate power to the vacuum pumps. The upper switch controls the upper frame pump; the lower switch controls the lower frame pump.

5. LAMP IGNITION SWITCHES (2)

Activate power to the exposure lamp ignition circuits. The upper switch is for the upper lamp; the lower switch is for the lower lamp.

S/N 476 & Lower: Pushbutton switches — These cannot be used to turn off the lamps.

S/N 477 & Higher: Twist switches — Turn to "O" to turn off the lamp; turn to "I" to start the lamps.

6. LAMP CIRCUIT PILOT LAMPS (2)

Indicate power to the exposure lamp circuits.

S/N 476 & Lower: Pilot lamps illuminate centers of lamp ignition switches.

S/N 477 & Higher: Separate clear lens lamps.

7. LAMP IGNITION PILOT LAMPS (2)

Each indicates that its exposure lamp is ignited.

S/N 476 & Lower: Amber lens

S/N 477 & Higher: Blue lens

8. LAMP READY PILOT LAMPS (2)

(Green lens) Each indicates that its exposure lamp is ready for exposure.

9. LAMP INTENSITY SELECTOR SWITCH

Selects the exposure intensity mode for both lamps.

S/N 476 & Lower:
Pushbutton switch — Lighted when lamps are in 5000-watt mode.

S/N 477 & Higher:
Twist switch — Panel labeled with intensity mode positions.

10. EXPOSURE LAMP HOUR METERS (2)

Indicate total operating hours of the upper and the lower exposure lamps. These meters are not resettable.

11. EXPOSURE COUNTER

Indicates the number of exposures, pushbutton resettable.

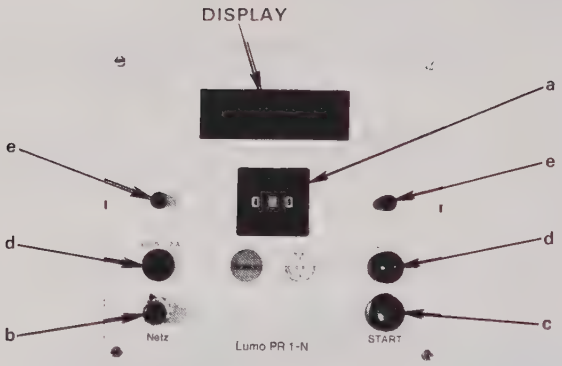


Figure III-2. Integrator Features and Controls

12. EXPOSURE CONTROL INTEGRATORS (2)

Automatically adjust the exposure time for the lamp intensity and the exposure frame being used. The upper integrator is for the upper lamp; the lower integrator is for the lower lamp. The digital display shows the operator-selected number of light units, **not** the exposure time. The controls and features on the face of each integrator are:

a. **Number Selector Dials:** Allow quick changes of each display number.

b. **On-Off Switch:** Activates the number display and integrator operation when the exposure lamp is operating.

c. **Start Switch:** Can be used to start an exposure for the corresponding exposure lamp.

d. **Fuseholders (2):** Contain fuses for the integrator's control circuits (0.2 amp and 2.0 amp).

e. **Exposure Calibration Trimpots (2):** Used to adjust the integrator count rate for balanced exposures on each side of each exposure frame. The left adjustment pot is for the upper frame; the right adjustment pot is for the lower frame.

13. MANUAL EXPOSURE TIMER

Can be used for **timed** exposures up to 60 seconds. The outer ring sets the time period; the center button starts the timed exposure. If both lamps are operating, the shutters on both lamp housings open and close together; the integrator system does not operate during timed exposures.

A timed exposure can be stopped by turning the center button clockwise.

14. EXPOSURE START SWITCH

Starts integrator-controlled exposures for normal operation.

15. FRAME ILLUMINATION SWITCH

Lights the fluorescent lamps under the yellow glass panel to aid in phototool registration.

B. ROUTINE START-UP

1. Turn the power on at the wall-mounted disconnect switch.
2. Turn on the Printer at the main power switch on the control panel.
3. Turn on the exposure lamps:

   a. Pushbutton Switch Models:

   (1) Push in both lamp ignition switches to turn on the exposure lamps. The center of each switch will light to indicate power to the lamp circuit and the amber pilot lamps will glow when the lamps ignite. After a five minute delay period, the green ready pilot lamps will glow and the integrators will turn on. If exposing single-sided boards, turn on the upper lamp only.

   (2) Select the lamp intensity desired by pushing the intensity selector switch. The lamps will expose at 5000 watts when the center of the selector switch is lighted.

   b. Twist Switch Models:

   (1) Turn both lamp ignition switches to "I" to ignite the lamps; the switches will return to the center position when released. The clear pilot lamps will glow to indicate power to the lamp circuits and the blue pilot lamps will glow when the lamps ignite. After a five-minute delay period, the green ready lamps will glow and the integrators will turn on. If exposing single-sided boards, turn on the upper lamp only.

   (2) Select the lamp intensity desired by setting the intensity selector switch to 2000 or 5000 watts.

NOTE: ALL MODELS — If the lamps have recently been turned off, they will not reignite until they have cooled. When the lamp ignition switches are turned on, the blower will run at high speed to cool the lamps, then slow to low speed when the lamps ignite.

4. Set the number of light units on each integrator that will give the correct exposure for the RISTON® Film being used. (See Section III-E for procedures for determining the proper exposure settings.)

5. Turn on both vacuum pumps if both exposure frames are to be used. If only one frame is to be used, start the pump for that frame only. The center of the pushbutton switches will be lighted when the pump is operating; the twist switches should be set at "I" for the pumps to operate.

C. ROUTINE OPERATION

1. Allow at least 15 minutes between start-up and the first exposure to ensure that the lamps are fully warmed up.

2. Check that the integrator count settings are correct for the resist being used.

3. Turn on the frame illumination lamps.

4. Pull one exposure frame out to the ends of the tracks to release the vacuum. Raise the top half of the frame.

5. Place the panel and phototools in the center of the frame. Bleeder strips may be needed for proper vacuum withdrawal with small panels.

CAUTION: Do not wear watches, bracelets, or rings, especially diamond rings, when operating the Printer. Jewelry may scratch the frame glass and cause exposure defects.

6. After registering the panels and phototools, close the top half of the frame and smooth the cover sheet over the panel to minimize air entrapment.

7. Move the exposure frame forward about 25 mm (1 inch) into the vacuum drawdown notch in the frame channel.

8. It may be necessary to squeeze the frame together slightly to seal it. If operating at maximum vacuum level, the vacuum gauge for that frame should register at least 80 percent.

NOTE: We recommend the use of bleeder veins to remove air from the area of the panel to the edge of the vacuum channel. If unembossed MYLAR® Film cover sheets are used, look for "Newton rings" on the panel area as an indication of good contact between the phototool and the panel. Contact your RISTON® Technical Representative for more detailed information.

9. Push the exposure frame completely into the Printer, then push the exposure START button to begin the exposure.

10. If both exposure frames are being used, load a new panel and phototools into the other frame and draw a vacuum on the frame while the first frame is exposing.

11. When **both** integrators have finished counting, push the second frame into the Printer to remove the frame just exposed. Pull the exposed frame out to the ends of the tracks to release the vacuum.

NOTE: Resist exposure is controlled by a shutter system between the lamps and the frames. The resist will not be overexposed if it is left in the Printer cabinet after the integrators finish counting.

12. Open the top half of the exposure frame and remove the exposed panel and phototools.

13. Repeat step Nos. 5 through 12 for each exposure.

CAUTION! Do not allow the vacuum frames to rest in the vacuum drawdown position unless the frames are closed and sealed. Turn the vacuum pumps off during breaks in the production and during lunch periods. Running the pumps with no load can damage them. The vacuum gauges should always indicate either "0" or "80%" under normal conditions.

D. IDENTIFYING THE EXPOSURE FRAME SURFACES

The exposure surfaces of the two frames are generally referred to as sides 1, 2, 3, and 4 as shown in the following table. Identifying panel sides in this way simplifies references as to which frame the panel was in and to which lamp that panel side was exposed.

Exposure Frame Side	Side No.
Top Side of Upper Frame	1
Bottom Side of Upper Frame	2
Top Side of Lower Frame	3
Bottom Side of Lower Frame	4

E. DETERMINING INTEGRATOR COUNT SETTINGS

The integrator count settings must be determined for proper exposure of the resist with the phototools to be used. The count settings are reference numbers not time units. The exposure times are determined by the

integrator count rate, which is automatically controlled in the PC-130 by the light intensity at the frame being exposed.

NOTE: The integrator count settings for the same exposure level on the same resist type will normally vary from one PC-Printer to another. Therefore, do not use the count settings of another PC-Printer for reference.

1. PHOTOTOOLS USED

The ultraviolet light transmission of phototools can vary a great deal depending on the materials used and their quality. Always use the same phototools that will be used in each frame when determining the correct integrator count settings.

2. EXPOSURE LEVEL MEASUREMENT

Refer to the RISTON® or VACREL® Film Data Sheet for the recommended density tablet step range and the exposure **time** recommended for proper exposure on a PC-Printer. Be certain to use the Data Sheet for the same film type and thickness that will be exposed.

Either RISTON or Stouffer density step tablets may be used for RISTON® Films. RISTON step tablets are preferred, however, because they permit finer control of exposure levels, allowing better use of the Printer's exposure accuracy. In the normal RISTON® Film exposure range, one Stouffer step is equal to three RISTON steps.

3. COUNT SETTING PROCEDURE

This procedure assumes that the light energy at each side of each exposure frame does not differ more than 10% from any one side to another. If you are uncertain about this exposure balance, proceed to Section V-I of this manual before continuing.

a. Prepare at least 6 double-sided test panels laminated with the photoresist to be used for production.

NOTE: Test panels used for determining integrator settings should be considered as important as production panels. Do not use panels that have been laminated and stored for more than three days; do not reuse panels previously laminated and exposed.

b. Run blank exposures at the exposure intensity to be used and adjust the integrator count settings until the exposure **times** are close to the times recommended in the Film Data Sheet. Use the same count setting on both integrators.

c. Mark one test panel for sides 1 and 2 and place it and the phototools in the center of the upper exposure frame. Put a density step tablet on each side of the panel between the resist and a **clear** area of the phototool to be used in that frame.

d. If 5000-watt exposures are to be used, run at least two blank exposures to heat up the lamps before putting the test panel into the Printer and exposing it.

e. Expose the test panel and record the exposure time in seconds for the upper integrator (side 1). Hold the test panel for 15 minutes before developing it.

f. Repeat steps c, d, and e for sides 3 and 4 in the lower exposure frame. It is not necessary to record the exposure time for this frame.

g. Check the exposure steps held on sides 1, 2, 3, and 4. If the highest and the lowest steps held differ by more than 2 RISTON steps (about one Stouffer step), the densities of the phototools may be different or the integrators may need recalibration. Check the densities of the phototools used; if they are uniform, recheck the exposure balance.

h. Since any changes in the integrator count settings will affect all four sides equally, the rest of this procedure will reference side No. 1 only.

i. Compare the exposure step held on side 1 with the recommended exposure level. If the step held on the side 1 test panel is higher, the count settings of both integrators must be lowered to reduce the exposure time. Change both integrators the same amount.

A 10 percent change in the **exposure time** (not the count settings) should change the exposure level about one RISTON step. (RST).

EXAMPLE:

1. An RST 10 is recommended for the resist used. The integrator setting of 50 counts gave a 20-second exposure time for side 1 and an RST 14 on the test panel.

2. The four RISTON steps difference (RST 14 minus RST 10) means that a 40 percent reduction in exposure time is needed to get an RST 10.
3. Run blank exposures with the upper frame in the Printer and keep reducing the integrator count settings until the exposure time for the upper integrator is 12 seconds (40 percent less than 20 seconds).

j. Run another series of test panels to check the steps held at the adjusted setting.

F. CHECKING EXPOSURE LEVELS

The exposure levels (density tablet steps held) on each side of both exposure frames should be checked at least once per shift — more often for fine-line work. Density step tablets should be used under non-critical clear areas of the phototools on production panels or test panels. Be certain to hold the test panels at least 15 minutes before developing. The exposure steps held should be within the guidelines specified in the RISTON® or VACREL® Film Data Sheet for the resist used or in the guidelines otherwise specified for the job. The exposure levels on each side of each frame should be within 2 RISTON density tablet steps of each other (about one Stouffer tablet step). If the exposure levels vary more than three RISTON steps, the integrators should be recalibrated. Do not attempt to adjust the exposure level on one frame side by changing the integrator count setting; the exposure level on the same side of the other frame will be affected by the same amount.

Integrator recalibration should only be attempted by qualified personnel; see Section V-I of this manual for procedures.

NOTE: Test panels used for checking exposure levels should be considered as important as production panels. Do not use panels that have been laminated and stored for more than three days; do not reuse panels previously laminated and exposed.

G. ADJUSTING THE VACUUM LEVEL

The vacuum level in each exposure frame can be adjusted by bleeder valves on the control panel. This feature is for use when lower than normal vacuum is required for glass phototools or other special uses.

CAUTION! Do not lower the vacuum level unless it is absolutely necessary. The vacuum should never be adjusted below 50% for any reason. Operating at less than maximum vacuum will increase the maintenance requirements for the vacuum pumps.

1. Put the exposure frame that is out of the Printer into the vacuum drawdown position.
2. Push the vacuum pump switch on the control panel to start the pump for that frame.
3. Squeeze the frame to seal it and wait until the vacuum gauge reaches its maximum level.
4. Use a small screwdriver to adjust the bleeder valve for that frame (upper valve for the upper frame) until the vacuum is at the desired level. Turn the valve counterclockwise to lower the vacuum level.
5. Repeat the procedure for the other frame.

H. ROUTINE SHUTDOWN

The PC-130 Printer can be shut down by simply turning off the main power switch on the control panel; this turns off all machine functions including the exhaust blower.

The exposure lamps cannot be turned off separately on printers with pushbutton control panel switches. However, it is not necessary to allow the blower to run for a cool-down period with the PC-130 Printer.

Do not turn off the Printer for periods of less than one hour. The minimum recommended operating time is four hours per start-up.

NOTE: The transformer consumes power whenever it is energized. If the Printer is shut down for an extended period, turn off the power to the transformer at the disconnect box.

I. FINE-LINE IMAGE RESOLUTION

The exposure lamps lose intensity with use, increasing the exposure time required for the proper exposure level on the resist. Long exposure times can adversely affect image resolution of circuit images with lines and spaces that are 5 mils or finer. The general recommendation for fine-line patterns is that the exposure lamps be replaced when the light intensity at the resist is 6 to 7mW/cm^2. However, by monitoring the light intensity versus the image resolution of your fine-line

patterns, you may determine the minimum light intensity for acceptable resist performance.

For less critical exposures, the lamps should be replaced when the light intensity is 4 mW/cm^2, or when the exposure times become too long for the desired production rate.

For more detailed information on fine-line image resolution, contact your RISTON® Products Technical Representative. Ordering information for light intensity meters can be found under Component Vendors and Repair Services in Section VI — Parts.

IV. MAINTENANCE

● SAFETY

1. Unless it is necessary for service, disconnect the power before opening the access panels on the Printer, exhaust blower, or transformer.

WARNING

We recommend actually locking out the main power disconnect to the transformer to pervent others from powering the unit. If this is not possible, tag or tape the main power switch on the Printer to inform others of the danger. Protect yourself!

2. Wear safety glasses when working on the exposure lamps or the lamp housings.

3. When possible, do not service the interior of the unit with the lamps energized. If it is absolutely necessary to open the Printer with the lamp on, wear suitable protective clothing. Only authorized personnel should have access to the key for the door interlock bypass switch (S/N 477 & Up).

WARNING

The intense ultraviolet light can cause serious eye damage. There is exposed 400-volt electrical wiring in the Printer, transformer, and exhaust blower. The metal surfaces and exposure lamps in the Printer can be very hot.

4. Wear leather gloves when handling glass panels. The sharp edges can cause serious cuts.

A. MAINTENANCE CHECKLIST

A preventive maintenance checklist, based on operating the Printer one or two shifts per day, is included at the end of this section.

Use the hour meters on the control panel to record the operating hours for service intervals.

B. MAINTENANCE PROCEDURES

The following procedures correspond directly to those listed in the maintenance checklist. Repair, replacement, and adjustment procedures are outlined in Section V — Service.

1. DAILY

a. Exposure Frame Cleaning: The exposure frame glass and cover sheets should be kept meticulously clean. Dirt and resist flakes on these surfaces will cause exposure defects on the panels.

To clean the underside of the frame glass, pull the frame out to the ends of the tracks and lift it up with the rollers aligned with the vertical slots in the tracks. (See Figure IV-1.)

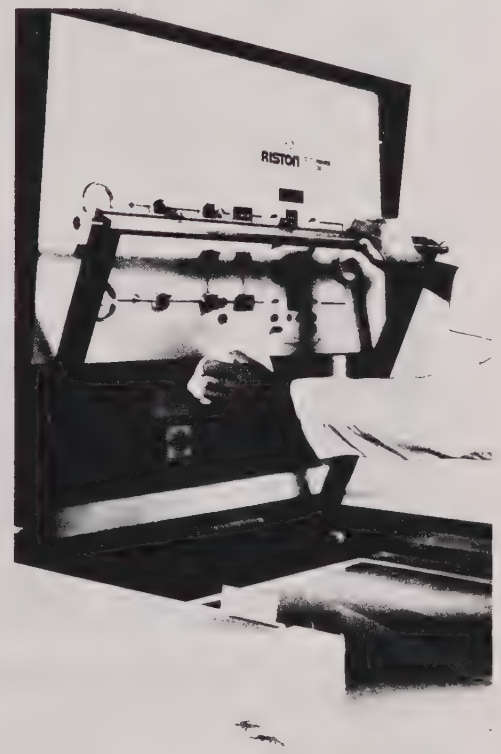


Figure IV-1. Cleaning Underside of Frame Glass

b. Exposure Frame Inspection: Check the condition of the cover sheets on both exposure frames. The MYLAR® Film should be free of holes, creases and scratches; replace the MYLAR as necessary. Check the rubber seals on the upper half of each frame for cuts or nicks which could cause vacuum leaks and slow frame evacuation; replace the seals as necessary.

c. Heat Shield Glass Cleaning: The cleaning frequency for the heat shield glass in the exposure cabinet depends upon the cleanliness of the

yellow room. We recommend cleaning the glass daily when the Printer is first installed; experience will then show whether less frequent cleaning will be adequate. Cleaning frequency should not be less than once per week.

The upper and lower heat shield glass panels should be cleaned before the exposure lamps are turned on. If the Printer is not equipped with side door access door interlocks, take precautions to prevent someone from starting the lamps while the doors are open.

Open both side access doors and the four inner access doors inside the cabinet (Figure IV-2). Clean both sides of the upper and lower glass panels with a non-ammonia cleaner; alcohol is satisfactory. The panels may be lifted out of their frames and removed from the cabinet to simplify cleaning; wear gloves and be careful not to break the glass. Clean the surfaces of the photodectors with a soft, dry cloth.

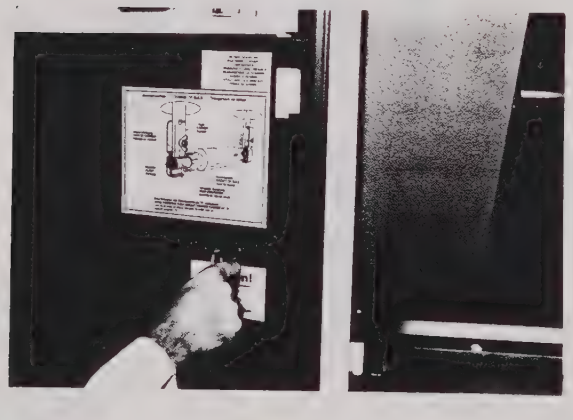


Figure IV-2. Opening Inner Access Door

2. WEEKLY

Check Vacuum Pump Oil: The vacuum pumps are located in the lower cabinet in the front of the Printer. Remove the lower access panel and slide out the vacuum pump service tray for easy access (Figure IV-3).

The oil level should be checked weekly when operating at full vacuum, more frequently if at less than a 70% vacuum. The oil sight glasses are located on the right side of each pump. The **minimum** oil level is halfway up the sight glass. If low, fill the pumps to the brim of the fill plug hole with SAE 30-weight, non-detergent motor oil. Note the following cautions.

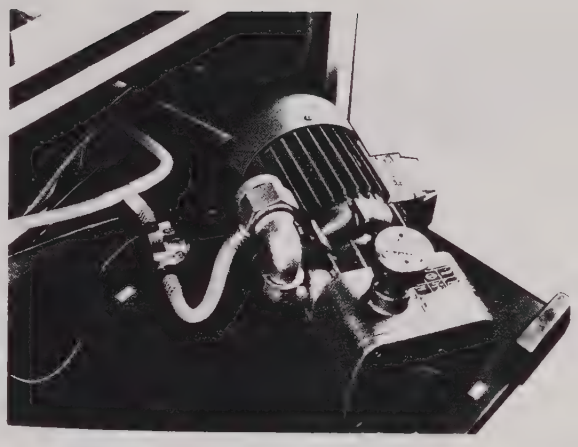


Figure IV-3. Vacuum Pump Service Tray (Pulled out of Compartment)

CAUTION! Never use vacuum pump oil in these pumps. Use SAE 30 weight non-detergent motor oil only.

Use extreme caution when sliding the pumps' service tray into the cabinet to avoid pinching the wires behind the tray (Figure IV-3).

3. EVERY 200 OPERATING HOURS

a. **Vacuum Pump Oil Change:** Change the pump oil every 200 hours if operating at full vacuum; change it every 125 hours if operating at less than 70% vacuum.

   The vacuum pumps are mounted on a tray which can be pulled out for service. The oil drain plugs are located next to the sight glasses on the right sides of the pumps. The fill plugs are just above the drain plugs; fill the pumps to the brim of the fill plug holes with SAE 30-weight non-detergent motor oil. Note the preceding cautions.

b. **Vacuum Pump Air Filter:** Unscrew the filter covers on top of the pumps and remove the paper filters in the air intakes. Tap the filters lightly on a benchtop to loosen any dirt, or use compressed air to clean them. If either filter is torn or plugged, replace it.

4. EVERY 1000 OPERATING HOURS

Clean the vacuum pumps and replace the oil separator cartridges every 1000 hours if operating at full vacuum, every 500 hours if operating

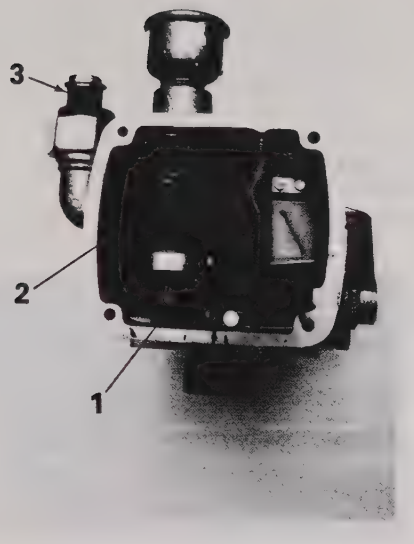


Figure IV-4a. Vacuum Pump — Face Plate Removed

1 — Oil Return Line

2 — Oil Separator Cartridge

3 — Paper Filter

Figure IV-4b. Vacuum Pump — Partially Disassembled

4 — Faceplate Gasket

5 — Metal Sponge Filter

6 — Oil Separator Seals

at less than 70% vacuum. To clean the pumps and replace the cartridges refer to Figures IV-3, 4a, and 4b and the following procedures:

a. Open the lower access door on the front of the Printer and slide out the vacuum pump service tray.

b. Unbolt each vacuum pump from its mounting studs.

c. Label the wires to each pump so each wire can be replaced on the same terminal to prevent the pumps from running backwards. Remove the wires and disconnect the vacuum lines.

d. Remove the pumps and place them on a workbench for service.

e. Remove the drain plug to drain the oil. Replace the plug.

f. Remove the fan housing from the pump motor. Clean the housing and the fan. Do not replace the housing now.

d. Remove the pumps and place them on a workbench for service.

e. Remove the drain plug to drain the oil. Replace the plug.

f. Remove the fan housing from the pump motor. Clean the housing and the fan. Do not replace the housing now.

g. Remove the oil fill plug and fill the pump with an oil-cutting solvent such as kerosene or mineral spirits. Replace the plug.

h. Manually turn the motor fan to circulate the solvent through the pump. Allow the solvent to soak for 15 minutes.

i. Drain and refill the pump with solvent, turn the fan to circulate it, and allow it to soak for 15 minutes before draining.

j. Remove the faceplate of the pump with a 5mm hex (allen) wrench.

k. Remove the 9 mm bolt attaching the oil return line to the base of the oil separator cartridge.

l. Use an adjustable wrench to loosen the stud below the cartridge and remove the cartridge.

m. Remove the metal sponge filter from the right

side of the pump chamber. Push a wire into the oil passage behind the filter mounting and through the oil separator cartridge return line to be certain they are clear.

n. Install a new oil separator cartridge. The cartridge seals must be aligned with the vent hole in the top of the pump.

o. Clean the metal sponge filter in solvent and replace it in the pump chamber.

p. Remove the old gasket from the faceplate and reinstall a new gasket. Silicone sealer may be used if a new gasket is not available.

q. Replace the paper filter in the pump's air intake.

r. Replace the motor fan housing.

s. Refill the pump to the brim of the oil fill plug hole with SAE 30-weight non-detergent motor oil.

CAUTION! Never use vacuum pump oil in these pumps. Use extreme care when sliding the pumps' service tray into the cabinet to avoid pinching the wires behind the tray (Figure IV-3).

t. Reinstall the pumps in the Printer; reconnect the electrical wiring and vacuum lines.

u. Turn on the vacuum pumps and check the gauge reading for each pump. If there is low or no vacuum, the pump may be running backwards; reverse any two of the three wire connections to the pump and recheck vacuum readings.

v. Check the oil level after 5 to 10 minutes' operation.

5. EVERY SIX MONTHS

a. **Door Latches:** Lubricate the quarter-turn latches on all cabinet access doors and the control panel latch with penetrating oil or a silicone-based lubricant.

b. **Shutter Housings:** (See Figure IV-5.) Lightly lubricate the shutter drive chains and shutter door pivots with a few drops of 30-weight oil. Lubricate the small idlers and pivot idlers near the microswitch cams with a spray lubricant. If the shutter door movement is stiff or binding, the idler sprockets should be removed and cleaned; see Section V — Service — for procedures.

c. **Exposure Frame Transport:** The exposure frame transport chains and sprockets should only be lubricated if frame movement becomes difficult. If required, apply a very light coating of 30-weight oil on the chains on both sides of the frames.

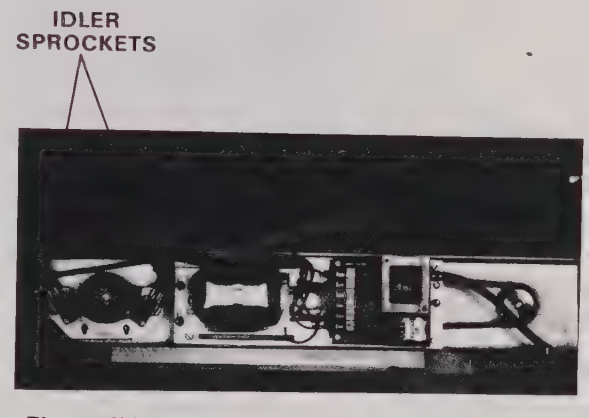


Figure IV-5. Lamp Shutter Assembly

Check the transport chain tension from inside the Printer cabinet. Tighten the chains if there is more than 1/4-inch of a slack. Refer to Figure IV-6 for the chain tensioner location.

Figure IV-6. Frame Transport Chain Tensioner

d. **Exhaust Blower:** Clean the impeller of the remote-mounted, two-speed exhaust blower to insure maximum efficiency. Less frequent cleaning may be acceptable, depending on the cleanliness of the yellow room. Remove the blower housing to get access to the impeller. Use a vacuum cleaner to remove the dust build-up and replace the housing.

e. **Exposure Lamp Reflectors:** Dampen a cloth with alcohol and clean the reflectors in both

lamp housings every six months and whenever the exposure lamps are replaced.

f. **Vacuum Hoses:** Check the vacuum hoses in the exposure cabinet and at the vacuum pumps for signs of brittleness or cracking. If defective, replace the hoses with 8-mm (5/16-in.) I.D., 3-mm (1/8-in.) wall, nylon-reinforced hose. If reinforced hose is not available, use hose with a heavier wall thickness.

g. **Exhaust Air Temperature:** The exposure lamp temperature is critical for proper performance. The lamp cooling airflow rate can be adjusted with the dampers in the lamp exhaust ducts to give the proper lamp temperature.

NOTE: The exhaust air temperature should always be checked with NEW exposure lamps and after cleaning the exhaust blower impeller. (See Item 5-d.)

(1) Allow the Printer to idle with the lamps at 2kW for **one hour** after startup or exposing at 5kW.

(2) Interlock equipped models only: Remove the power pack access door and use the special key to unlock and release the interlock bypass switch.

(3) Turn off the integrator power switches and set the manual timer to zero to prevent starting an exposure during the adjustment procedure. Open the right side door.

WARNING

This procedure requires the side doors to be open with the exposure lamps on. Avoid looking at the light; the intense ultraviolet light can cause serious eye damage.

(4) Remove the hole plug on the end of the upper lamp air duct (Figure IV-7). Insert an accurate temperature probe approximately 50 mm (2 inches) into the hole.

(5) The air temperature in the duct should be 55°C to 60°C (131°F to 140°F). Refer to Figure IV-7 and adjust the damper as necessary to set the air temperature.

(a) Loosen the lock nut on the damper.

(b) Move the damper about ¼ inch for each adjustment. (Close the damper to raise the air temperature.)

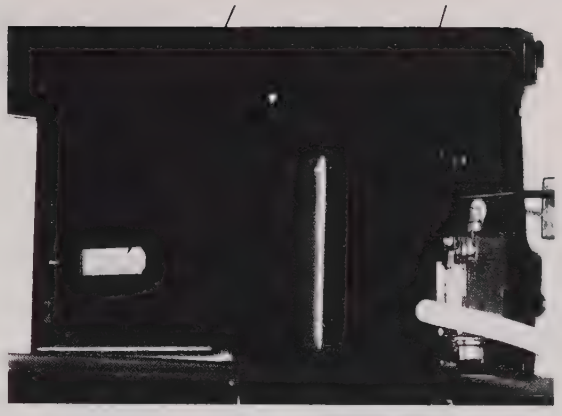


Figure IV-7. Upper Lamp Air Duct (Test Hole Plug and Damper)

(c) Wait five minutes after each adjustment before checking the air temperature.

(d) Repeat the adjustment until the air temperature is in the recommended range.

(e) Tighten the damper lock nut.

(6) Repeat the damper adjustment procedure for the lower lamp air duct.

6. EXPOSURE LAMP REPLACEMENT

The exposure lamps lose intensity with use, increasing the exposure time required for the proper exposure level on the resist. Long exposure times can adversely affect image resolution of circuit images with lines and spaces that are 5 mils or finer. The general recommendation for fine-line patterns is that the exposure lamps be replaced when the light intensity at the resist is 6 to 7 mW/cm^2. However, by monitoring the light intensity versus the image resolution of fine-line patterns, you may determine the minimum light intensity for acceptable resist performance.

For less critical exposures, the lamps should be replaced when the light intensity is 4 mW/cm^2, or when the exposure times become too long for the desired production rate.

For more detailed information on fine-line image resolution, contact your RISTON® Products Technical Representative. Ordering information for light intensity meters can be found under Component Vendors and Repair Services in Section VI — Parts.

PC-130 PRINTER
PREVENTIVE MAINTENANCE CHECKLIST

ITEM NO.	DESCRIPTION	MAINT. SCH.	COMPLETE	REPAIRS MADE/ PARTS USED
1a	Clean Exposure Frames	Daily		
1b	Inspect Exposure Frames	Daily		
1c	Clean Heat Shield Glass	Daily		
2	Check Vacuum Pump Oil	Wkly.		
3a	Vacuum Pump Oil Change	200 Hrs.		
3b	Clean Pump Air Filters	200 Hrs.		
4	Clean Vacuum Pumps and Replace Oil Separator Cartridges	1000 Hrs.		
5a	Lubricate Door Latches	6 Mos.		
5b	Lubricate Shutter Housings	6 Mos.		
5c	Lubricate Exposure Frame Chains	6 Mos.		
5d	Clean Exhaust Blower	6 Mos.		
5e	Clean Lamp Reflectors	6 Mos.		
5f	Check Vacuum Hoses	6 Mos.		
5g	Check Exhaust Temperature	6 Mos.		
6	Replace Exposure Lamps	As req'd		

V. SERVICE

● SAFETY

1. Unless it is necessary for service, disconnect the power before opening the access panels on the Printer, exhaust blower, or transformer.

WARNING

We recommend actually locking out the main power disconnect to the transformer to prevent others from powering the unit. If this is not possible, tag or tape the main power switch on the Printer to inform others of the danger. Protect yourself!

2. Wear safety glasses when working on the exposure lamps or the lamp housings.

3. When possible, do not service the interior of the unit with the lamps energized. if it is absolutely necessary to open the Printer with the lamps on, wear suitable protective clothing. Only authorized personnel should have access to the key for the door interlock bypass switch (S/N 477 & Up).

WARNING

The intense ultraviolet light can cause serious eye damage. There is exposed 400-volt electrical wiring in the Printer, transformer, and exhaust blower. The metal surfaces and exposure lamps in the Printer can be very hot.

4. Wear leather gloves when handling glass panels. The sharp edges can cause serious cuts.

A. ACCESS DOOR INTERLOCK AND BYPASS

PC-130 Printer serial numbers 477 and higher are equipped with a safety interlock system to prevent exposure lamp operation when a side access door is open. The system consists of switches actuated by brackets on the side access doors (Figure V-1) and a key-operated bypass switch behind the power pack access door (Figure V-2)

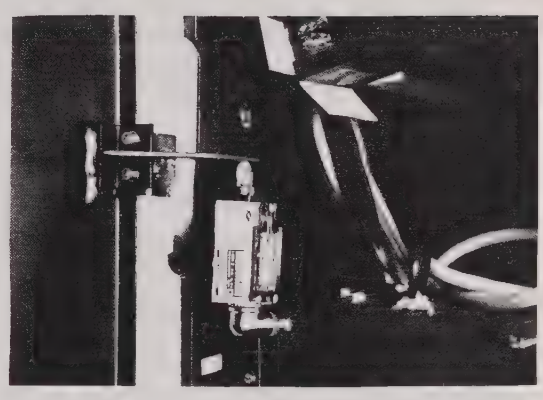


Figure V-1. Door Interlock Switch (S/N 477 & Up)

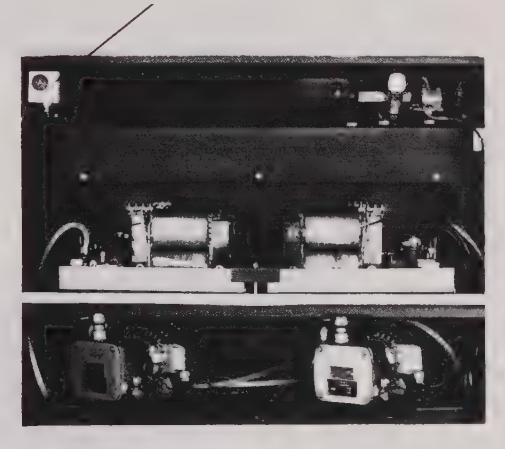


Figure V-2. Interlock Bypass (S/N 477 & Up)

The interlock and bypass switches operate contactor 1-K3 in the lamp power circuits. In normal operation the door switches activate 1-K3 to allow the lamps to operate. When a side door is opened, that door's switch interrupts power to 1-K3 and turns off both exposure lamps

The bypass switch is used when it is necessary to have a side door open with the exposure lamps on The interlock bypass key supplied with the Printer is used

to unlock and pop out the bypass switch which then keeps 1-K3 activated. After the required service is completed, close the side doors, remove the bypass key, and push in the bypass switch to replace the power pack access door. A bumper on the back of the power pack access door prevents replacement of the door when the switch is popped out. This prevents bypassing the door interlocks during normal operation.

B. EXPOSURE FRAME COVER SHEET REPLACEMENT

The MYLAR® Film cover sheet in the upper half of each exposure frame can be replaced with 4-mil or 7-mil clear film, or with 4-mil embossed film. If the embossed film is used, it should be installed so the smoother side of the film will contact the phototool to minimize the chance of the cover sheet's texture causing phototool movement during vacuum draw-down.

1. Remove the hex-socket screws around the outside of the upper half of the exposure frame. Use the metric hex key (allen wrench) supplied with the Printer or a 5/32-inch hex key (Figure V-3).

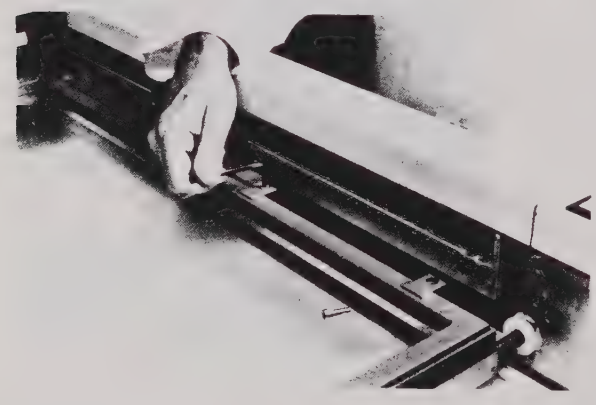


Figure V-3. Removing Exposure Frame Screws

2. Lift the inner square tubing frame out of the angle frame (Figure V-4).
3. Lift the vacuum channel and cover sheet out of the angle frame (Figure V-5).
4. Peel the old cover sheet from the double-sided tape on both sides of the vacuum channel.
5. If the double-sided tape has come loose from the channel or if it is no longer tacky, it must be replaced. The tape is actually a strip of adhesive — see Section VI — Parts for ordering information. Clean off the old adhesive with mineral spirits or other solvent.

Figure V-4. Removing Inner Frame

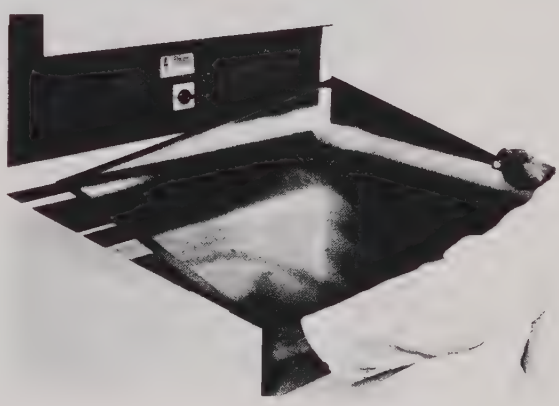


Figure V-5. Removing Vacuum Channel and Cover Sheet

6. Unroll a length of MYLAR® Film on a worktable. Provide a small amount of slack in the film to compensate for the size of the panels to be exposed. If glass phototools are used, the thickness of the glass must also be considered. This slack will prevent the unstretchable MYLAR® Film from tenting over the frame glass and forming air pockets.
7. Place the **flat** side of the vacuum channel on the MYLAR. Press down on all four sides to adhere the film.
8. If 4-mil film is used, cut it about 50 mm (2 inches) larger than the vacuum channel. If 7-mil film is used, cut it the same size as the channel.
9. Cut the 4-mil film at the corners as shown in Figure V-6. Fold the film tightly over the edges of the vacuum channel and press it firmly onto the double-sided tape. Trim the excess film from the channel.

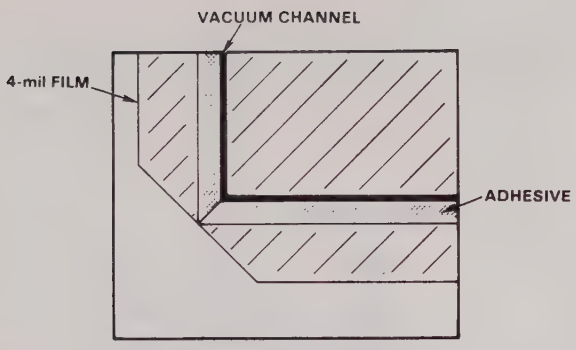


Figure V-6. Installation of 4-mil MYLAR® Film Cover Sheet

10. If 7-mil film is used, it will be necessary to apply strips of film over any exposed double-sided tape to prevent the vacuum channel from sticking to the exposure frame.
11. Replace the vacuum channel with the new cover sheet in the upper half of the exposure frame.
12. Place the square tubing frame on top of the vacuum channel inside the angle frame.
13. Replace the hex-socket screws around the outside of the upper half of the exposure frame. Snug the screws evenly — do not overtighten!

NOTE: Printer downtime for cover sheet replacement can be reduced by having spare vacuum channels with new cover sheets ready for direct replacement in the exposure frames. See Section VI — Parts for vacuum channel ordering information.

C. EXPOSURE FRAME VACUUM SEAL REPLACEMENT

1. Remove the hex-socket screws around the outside of the upper half of the exposure frame. Use the metric hex key (allen wrench) supplied with the Printer or a 5/32-inch hex key (Figure V-3).
2. Lift the inner square tubing frame out of the angle frame (Figure V-4).
3. Remove the vacuum channel and MYLAR cover sheet from the frame (Figure V-5).
4. Locate the butt joint of the old rubber seal and carefully peel the seal from the angle frame. Remove any seal left on the frame with a putty knife or gasket scraper.
5. Apply a coat of rubber cement to the underside of the new seal and on the mating surface of the angle frame (Figure V-7). Allow the cement to dry, then apply a second coat to both surfaces. Allow the second coat to dry until it is tacky.

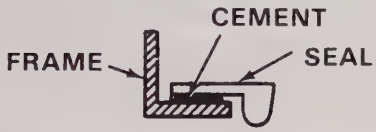


Figure V-7. Exposure Frame Vacuum Seal Installation

6. Start the end of the new seal in the center of one side.
7. Smooth out the rubber seal along the sides and make angle cuts at the corners so the seal joins evenly without gaps or overlapping.
8. The ends of the seal must butt together evenly without a gap or overlap. Remove the excess rubber cement and let the seal dry for one hour before using.
9. Reinstall the vacuum channel and cover sheet in the angle frame. Replace the inner frame and the hex-socket retaining screws.

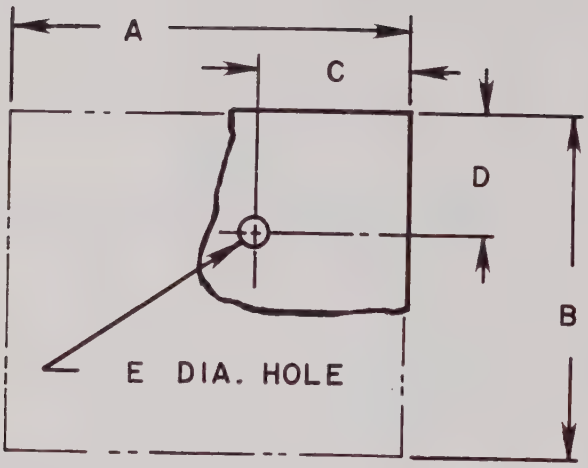
CAUTION! Do not overtighten the frame retaining screws.

D. REPLACING THE EXPOSURE FRAME GLASS

Replace the exposure frame glass if it is badly scratched, cracked, or broken. Scratches or cracks can cause exposure defects on the panels. Replacement glass can be obtained at a local glass shop if it has the capability of drilling a hole in the glass. Du Pont stocks the glass also. (See Section VI — Parts.)

The replacement glass should be 6 mm (1/4 in.) thick, soda-lime float glass with seamed edges. The glass dimensions and the location of the 10 mm (3/8 in.) diameter vacuum hole are shown in Figure V-8.

1. Raise the upper half of the exposure frame and remove the glass retainers on the front edge of the frame.
2. Slide the old glass panel out of the frame. Carefully remove any glass residue in the frame. Remove the plastic insert from the vacuum hole in the right rear corner of the glass.
3. Slide the new glass panel into the frame with the vacuum hole positioned in the right rear corner.



Dim.	mm	Inches
A	822	32-3/8
B	708	27-7/8
C	45	1-3/4
D	36	1-7/16
E	10	3/8

Figure V-8. Exposure Frame Glass Dimensions

Be certain that the vacuum cup under the glass is aligned with the hole and is in contact with the glass.

4. Place the plastic insert removed from the old glass into the vacuum hole in the new glass.
5. Replace the glass retainers on the front edge of the frame.
6. Clean both sides of the glass with a non-ammonia-based glass cleaner.

E. REPLACING THE HEAT SHIELD GLASS

If the heat shield glass panel in the Printer cabinet is broken, obtain replacement glass at a local glass shop. Du Pont stocks the glass also; see Section VI — Parts.

The replacement glass should be double-strength, soda-lime float glass with seamed edges. The glass dimensions are 616 mm x 714 mm (24 1/4 in. x 28 1/8 in.); the thickness of double-strength glass is nominally 3 mm (1/8 in.). Specifying seamed edges ensures that the sharp edges are removed.

WARNING

Wear gloves when handling glass panels; any sharp edges can cause serious cuts.

1. Turn off the power and lock it out.
2. Open one side access door of the Printer cabinet and the upper or lower inner access door to remove the broken heat shield glass. Check all areas of the cabinet, including the lower lamp housing, for glass residue.
3. Carefully place the new sheet of heat shield glass into its frame inside the Printer (Figure V-9). If possible, use a person on the other side of the Printer to help place it in the frame without breakage.

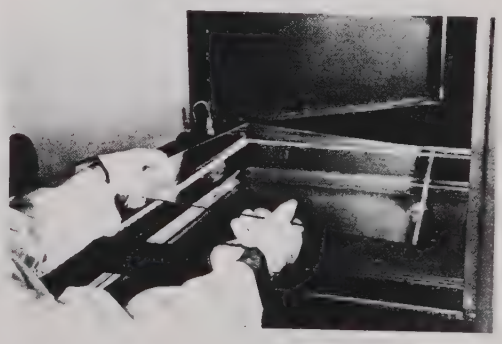


Figure V-9. Replacing the Heat Shield Glass

4. Clean both sides of the glass with a non-ammonia cleaner. If the installers' gloves are clean, the glass can be more easily cleaned before it is installed.

5. Close all access doors and restart the Printer.

F. EXPOSURE LAMP REPLACEMENT SERIAL NUMBERS 612 & HIGHER

The exposure lamps lose intensity with age and are normally replaced when exposure times become intolerably long. Typical lamp life is 1000 to 2000 hours of operation. Lamp burn-out can occur but the lamps are usually replaced before this happens. Under normal circumstances, both lamps should be replaced at the same time.

WARNING

Read and follow the safety procedures outlined at the beginning of this section before attempting to service the exposure lamps. If the Printer has been operating, the lamps and the lamp housings can be very hot.

1. Turn off the main power switch on the Printer. Lockout this switch or the main power supply.
2. Open both side access doors of the Printer cabinet.
3. Loosen the wing nut securing the stop bracket on the left side of the lamp housing and remove the bracket.
4. Pull out the slack in the lamp housing power cord and slide the housing out of the cabinet. Be careful that the rubber bellows behind the housing stays on the housing and is not damaged.
5. Turn the housing so the lamp and reflector are accessible.

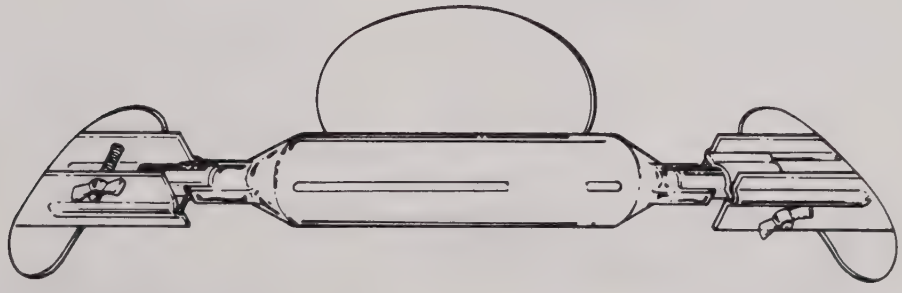


Figure V-11a. Exposure Lamp Mounting — PC-130 S/N 612 & Higher

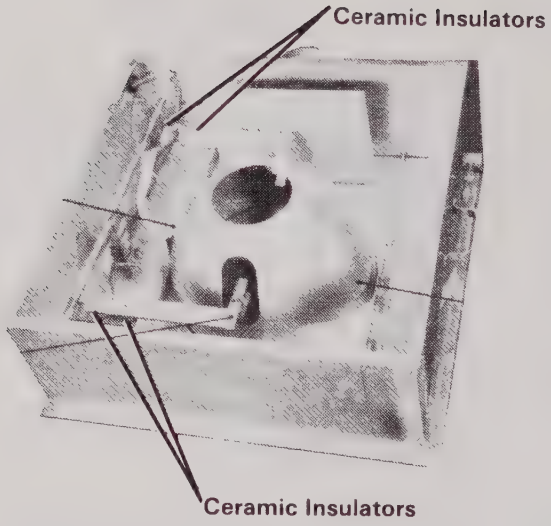


Figure V-12a. Exposure Lamp Housing — Cover Removed

6. Refer to Figure V-11a and loosen the wing nuts on each mounting clip of the lamp bracket.
7. Remove the lamp from the bracket and note the position of the lamp's mounting wings relative to the center barrel. (See Figure V-11a.)
8. Clean the reflector with a dry cloth or one dampened with alcohol.
9. Turn the housing over and remove the top panel. Inspect the ceramic insulators for cracks or other damage (Figure V-12a). If replacement is necessary, proceed to Section V-G for procedures.

   Replace the top panel and invert the housing to install the new lamp.

   CAUTION! Never move the lamp focus adjustment to inspect or replace the insulators. Refocusing the lamp is a lengthy, complex procedure.

10. Refer to Figure V-11a. Note that the mounting wings on the ends of the lamp are on opposite sides of the center barrel. Also note the locations of the channels for the wings in the lamp brackets relative to the clamping screws and wing nuts.

    The lamp must be positioned so the wings fit into the channels without binding and the lamp is parallel to the sides of the lamp housing.

11. Tighten the wing nuts on each lamp to securely hold the lamp and provide a good electrical connection.
12. Clean the lamp and reflector with a cloth dampened with alcohol.

    CAUTION! Dirt, grease, and fingerprints on the exposure lamps will burn into the glass and cause premature lamp failure.

13. Replace the lamp housing from the left side of the cabinet. To avoid damaging the bellows or restricting the flow of lamp cooling air, have a person on the other side of the Printer to help fit the rubber bellows onto the exhaust connection as the housing is pushed into the cabinet. Replace the stop bracket.
14. Repeat this procedure for the other lamp if it is to be replaced. Record the hourmeter readings for both lamps and post them on the Printer or file them for a record of lamp service hours.
15. Close and latch the side access doors of the Printer cabinet before unlocking the power.
16. The integrator calibration and exhaust air temperatures should be checked each time one or both lamps are replaced. Proceed to Section V-I and J.

G. CERAMIC INSULATOR INSPECTION AND REPLACEMENT

The ceramic insulators in the lamp housings (Figures V-12 or V-12a) provide electrical insulation between the

4. Clean both sides of the glass with a non-ammonia cleaner. If the installers' gloves are clean, the glass can be more easily cleaned before it is installed.

5. Close all access doors and restart the Printer.

F. EXPOSURE LAMP REPLACEMENT

The exposure lamps lose intensity with age and are normally replaced when exposure times become intolerably long. Typical lamp life is 1000 to 2000 hours of operation. Lamp burn-out can occur but the lamps are usually replaced before this happens. Under normal circumstances, both lamps should be replaced at the same time.

WARNING

Read and follow the safety procedures outlined at the beginning of this section before attempting to service the exposure lamps. If the Printer has been operating, the lamps and the lamp housings can be very hot.

1. Turn off the main power switch on the Printer. Lockout this switch or the main power supply.

2. Open both side access doors of the Printer cabinet.

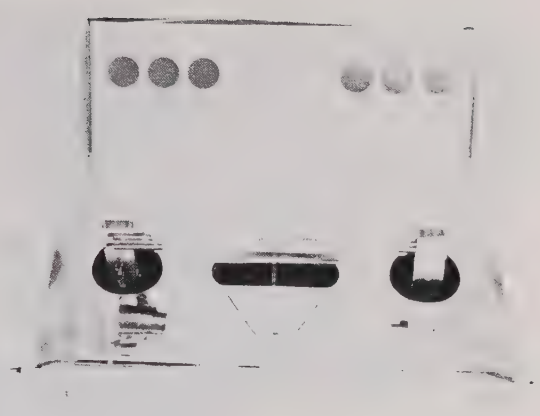


Figure V-10. Exposure Lamp and Reflector

3. Loosen the wing nut securing the stop bracket on the left side of the lamp housing and remove the bracket.

4. Pull out the slack in the lamp housing power cord and slide the housing out of the cabinet. Be careful that the rubber bellows behind the housing stays on the housing and is not damaged.

5. Turn the housing so the lamp and reflector are accessible (Figure V-10).

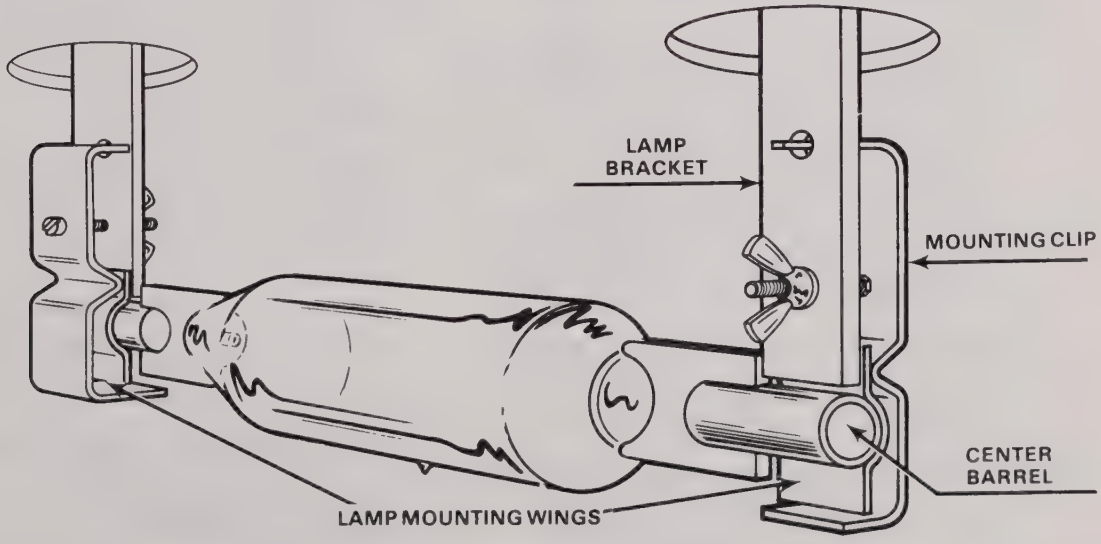


Figure V-11. Exposure Lamp Mounting

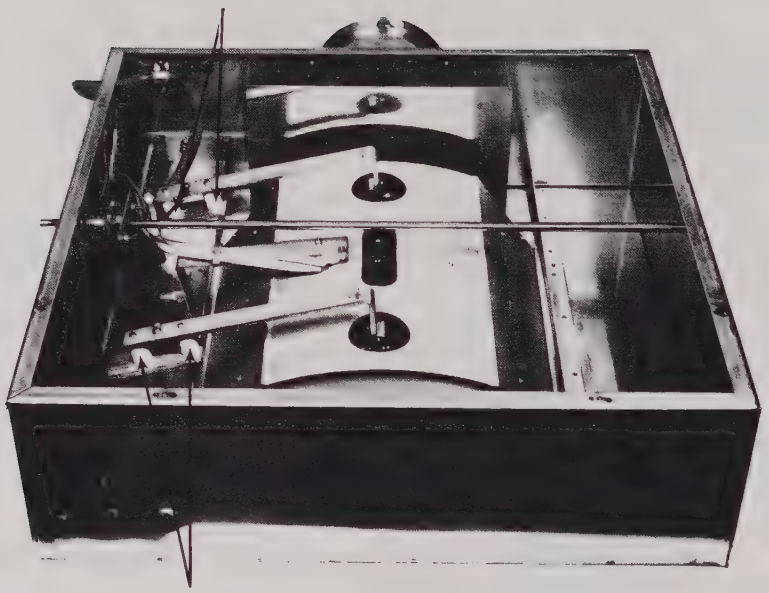


Figure V-12. Exposure Lamp Housing — Cover Removed (Ceramic Insulator Locations)

6. Refer to Figure V-11 and loosen the wing nuts on each mounting clip of the lamp bracket.
7. Remove the lamp from the bracket and note the position of the lamp's mounting wings relative to the center barrel. (See Figure V-11.)
8. Clean the reflector with a dry cloth or one dampened with alcohol.
9. Turn the housing over and remove the top panel. Inspect the ceramic insulators for cracks or other damage (Figure V-12). If replacement is necessary, proceed to Section V-G for procedures.

   Replace the top panel and invert the housing to install the new lamp.

   CAUTION! Never move the lamp focus adjustment to inspect or replace the insulators. Refocusing the lamp is a lengthy, complex procedure.
10. Refer to Figure V-11 and install the new lamp so the mounting wings on each end are toward the mounting clips. The center barrel of the lamp should be bottom of the lamp bracket.

    This positioning ensures that the lamp is horizontally and vertically parallel to the center line of the exposure frame.
11. Tighten the wing nuts on each lamp clip to firmly secure the lamp in the bracket.
12. Clean the lamp and reflector with a cloth dampened with alcohol.

    CAUTION! Dirt, grease, and fingerprints on the exposure lamps will burn into the glass and cause premature lamp failure.
13. Replace the lamp housing from the left side of the cabinet. To avoid damaging the bellows or restricting the flow of lamp cooling air, have person on the other side of the Printer to the rubber bellows onto the exhaust conn as the housing is pushed into the cabinet. Replace the stop bracket.
14. Repeat this procedure for the other lamp if it is to be replaced. Record the hourmeter readings for both lamps and post them on the Printer or file them for a record of lamp service hours.
15. Close and latch the side access doors of the Printer cabinet before unlocking the power.
16. The integrator calibration and exhaust air temperatures should be checked each time one or both lamps are replaced. Proceed to Section V-I and J.

G. CERAMIC INSULATOR INSPECTION AND REPLACEMENT

The ceramic insulators in the lamp housings (Figure V-12) provide electrical insulation between the

Printer frame and the lamp power supply. They are also a structural part of the lamp mounting brackets. If they are cracked or broken, they must be replaced to prevent changes in the lamp focus and potential electrical shorts.

1. Turn off the power and lock it out.
2. Remove one lamp housing from the left side of the Printer cabinet and set it on the floor. Do not strain the power cord.
3. Remove the top panel from the housing to gain access to the ceramic insulators (Figure V-12).
4. Inspect all four insulators for cracks and breaks. If any are damaged, they should all be replaced.
5. Remove the screws securing the top side of the insulators. Lay the lamp power wires aside.
6. Remove the screws securing the bottom side of the insulators. A right-angle screwdriver may be needed or the lamp and reflector may be removed to gain access to the lower screws. Be careful not to damage the overtemperature sensor.

   CAUTION! Do not move the lamp focus adjustment for any reason. This adjustment affects light uniformity and is very difficult to reset.
7. Install the new insulators and reconnect the lamp power wires.
8. Replace the reflector and lamp if removed. See Section V-F for important lamp installation details. Be careful not to damage the overtemperature sensor during reflector installation. Clean the lamp and reflector with a cloth dampened with alcohol to remove all fingerprints or grease.
9. Replace the top panel on the lamp housing and reinstall the housing in the cabinet. To avoid damage to the bellows or restricting the flow of lamp cooling air, have a person on the other side of the Printer fit the rubber bellows onto the exhaust connection as the housing is pushed into the cabinet (Figure V-13).

H. PHOTODETECTOR REPLACEMENT

The solid-state photodetectors sense the intensity of the exposure lamps and send a signal to the integrators on the control panel. Each lamp has one photodetector mounted on the exposure frame side of the heat protection glass in the Printer cabinet (Figure V-14). Separate circuits in each integrator control the count rate for the upper and lower frames. A defective photodetector will cause one integrator to count too slowly or not at all.

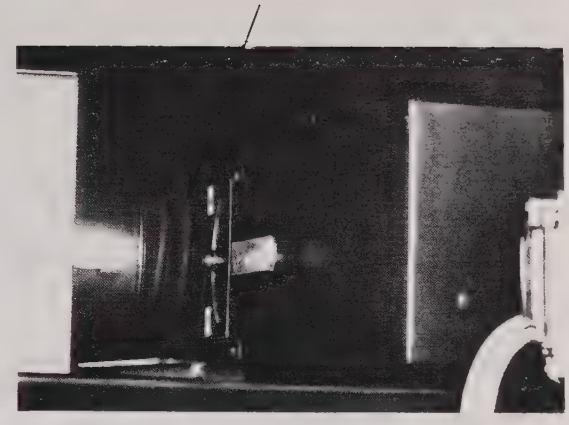


Figure V-13. Lamp Housing Rubber Bellows

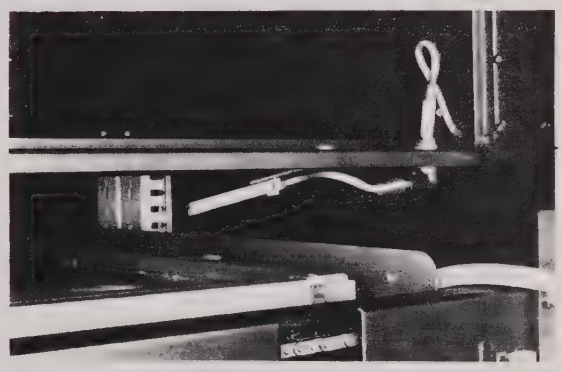


Figure V-14. Upper Photodetector Location

1. Turn off the power and lock it out.
2. Open the right side access door.
3. Move the exposure frames so they are both halfway into the Printer cabinet.
4. Each detector is located near the edge of the heat shield glass. Remove the two screws attaching the detector to its mounting bracket (Figure V-14).
5. Unscrew the detector's cable connector and remove the detector.
6. Reverse the preceding steps to install the new detector.
7. Replacing a photodetector requires recalibration of the integrators. Proceed to Section V-I

I. EXPOSURE BALANCE CHECK AND INTEGRATOR CALIBRATION

Dry film photoresists are sensitive to **light energy**,

which is a function of light intensity and the exposure time. **Light intensity** is measured in milliwatts per square centimeter (mW/cm^2); this intensity multiplied by the exposure time in seconds equals **light energy** which is measured in millijoules per square centimeter (mJ/cm^2).

The light energy which strikes the resist on each side of each exposure frame should not vary more than 10% from any one side to another. This exposure balance should be checked daily and must always be done after replacing an exposure lamp, integrator, or photodetector.

NOTE: Do not use phototools during exposure balance checks or during integrator calibration.

A light intensity meter (mW/cm^2) or light energy meter (mJ/cm^2) will simplify exposure balance checks and integrator recalibration. The meter probe should be sensitive to light wavelengths between 300 and 400 nanometers. Light meters are available from:

International Light, Inc.
5 Dexter Industrial Green
Newburyport, Massachusetts 01950
Telephone: (617) 456-5923

Request information on "Photoresist Radiometers."

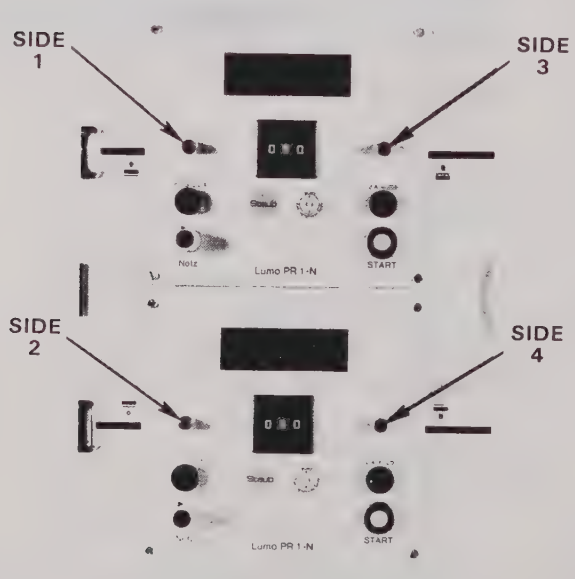


Figure V-15. Calibration Trimpot Locations

Figure V-15 and the following table show the integrator calibration trimpot locations for each side of each frame; the frame side numbers listed are referred to in the procedures. The integrator calibration trimpots can be labeled with the frame side numbers for convenient reference.

Exposure Frame Side	Side No.	Calibration Integrator	Calibration Trimpot
Top Side of Upper Frame	One	Upper	Left
Bottom Side of Upper Frame	Two	Lower	Left
Top Side of Lower Frame	Three	Upper	Right
Bottom Side of Lower Frame	Four	Lower	Right

The trimpots on the front of the integrators have a limited adjustment range which depends on the sensitivity of the photodetector. A coarse trimpot to extend this range is located on the back side of each integrator. Remove the plastic terminal block cover on the integrator; the coarse trimpot is located on the right side (Figure V-16). Turn the coarse trimpot **clockwise** to **increase** the energy level (exposure time); five full turns may be required.

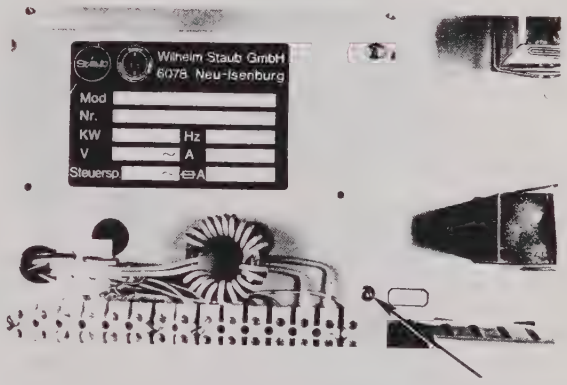


Figure V-16. Integrator Coarse Trimpot

NOTE: Adjusting the coarse trimpot affects the sensitivity range of BOTH calibration trimpots on the face of the integrator.

1. PROCEDURE WITH A LIGHT ENERGY METER (mJ/cm^2)

a. Set both integrators at the count setting normally used; use 100 if the setting is unknown. Use the same count setting on both integrators.

b. Turn off both vacuum pumps to avoid damaging the exposure frame cover sheets during the tests.

c. Place the meter probe in the center of the upper exposure frame, under the MYLAR® Film cover sheet, with the probe facing the upper lamp.

d. Put the exposure frame into the Printer and start a 5 kW exposure. Record the meter reading for side one.

e. Withdraw the upper frame, turn the probe over so it faces the lower lamp, and replace the frame in the Printer. Start a 5 kW exposure and record the meter reading for side two.

f. Repeat steps c, d, and e for the lower exposure frame (sides three and four).

g. If the difference between the highest and the lowest energy readings is 10% or less, the exposure balance is within normal tolerances for fine-line exposures.

h. If the difference between the highest and the lowest readings is greater than 10% the integrators should be recalibrated. Proceed with these instructions.

i. Determine which frame side exposures require adjustment and adjust the integrator trimpots as necessary until the light energies are within the recommended range.

NOTE: If the integrator count settings do not have to be a particular number, set the integrators at 100 counts and set all four frame sides to 200 mJ/cm^2. This setting will provide a convenient energy reference for exposures (2mJ/cm^2 per integrator count.)

j. Expose sample panels with density step tablets on all four frame sides to check the exposure level (steps held) and the exposure balance; all four sides should be within one RISTON exposure step.

k. Phototools absorb varying amounts of light energy, depending on the materials used and their quality. The operators must determine the integrator count settings required to compensate for any energy lost in the phototools used. That procedure is in Section III-E of this manual.

2. PROCEDURE WITH A LIGHT INTENSITY METER (mW/cm^2)

a. Set both integrators at a count setting normally used; use 100 if the setting is unknown. Use the same count setting on both integrators.

b. Turn off both vacuum pumps to avoid damaging the exposure frame cover sheets during the tests.

c. Place the meter probe in the center of the upper exposure frame, under the MYLAR® Film cover sheet, with the probe facing the upper lamp.

d. Put the exposure frame into the Printer and start a 5 kW exposure. Record the upper integrator exposure time in seconds and the light meter reading in mW/cm^2 for side one.

e. Withdraw the upper frame, turn the probe over so it faces the lower lamp, and replace the frame in the Printer. Start a 5 kW exposure and record the lower integrator exposure time and light meter reading for side two.

f. Repeat steps c, d, and e for the lower exposure frame (sides three and four).

g. Multiply the light intensity by the exposure time for each frame side to calculate the light energy for each of the four sides (mW/cm^2 x seconds = mJ cm^2).

h. If the difference between the highest and the lowest energy levels is 10% or less, the exposure balance is within normal tolerances for fine-line exposures.

If the difference between the highest and the lowest levels is greater than 10% , the integrators should be recalibrated. Proceed with these instructions.

i. Determine which frame side exposures require adjustment and calculate the exposure times needed to give the average or goal light energy (Energy ÷ Intensity = Time). Adjust the appropriate integrator trimpots to give the calculatd exposure times. Be certain that the proper exposure frame is in the Printer cabinet during the adjustments.

NOTE: If the integrator count settings do not have to be a particular number, set the integrators at 100 counts and set all four frame sides 200 mJ/cm^2. This setting will provide a convenient energy reference for exposures (2 mJ/cm^2 per integrator count).

j. Expose sample panels with density step tablets on all four frame sides to check the exposure level (steps held) and the exposure balance; all four sides should be within one RISTON exposure step.

k. Phototools absorb varying amounts of light energy, depending on the materials used and their quality. The operators must determine the integrator count settings required to compensate for any energy lost in the phototools used. That procedure is in Section III-E of this manual.

3. PROCEDURE WITH NO LIGHT METER

a. Laminate several test panels on both sides with RISTON® Photopolymer Film Resist. At least two RISTON or Stouffer density step tablets will be needed for the tests.

NOTE: Test panels used for checking exposure levels should be considered as important as production panels. Do not use panels that have been laminated and stored for more than three days; do not reuse panels previously laminated and exposed.

b. Set both integrators to a count setting normally used; use 100 if the setting is unknown. Use the same count setting on both integrators.

c. Place one panel in the center of the upper exposure frame. Label the top side "1" and the bottom side "2". (See the table at the beginning of this section for an explanation of the side numbers.) Place a step tablet on each side of the panel and draw vacuum on the frame. Put the upper exposure frame into the Printer and start a 5 kW exposure.

d. Place one panel in the center of the lower exposure frame. Label the top side "3" and the bottom side "4". Place a step tablet on each side of the panel and draw vacuum on the frame.

e. When the first exposure is completed, withdraw the upper exposure frame and start a 5 kW exposure on the lower frame. Remove the sample panel from the upper frame.

f. After the lower frame exposure is completed, withdraw the lower frame and remove the sample panel. Hold both panels for a minimum of 15 minutes before developing.

g. Develop both panels under normal production conditions. Be certain that the frame side identification (1, 2, 3, and 4) will be visible after development.

h. If the difference between the highest and the lowest exposure levels is two RISTON steps (about one Stouffer step) or less, the exposure balance is within normal tolerances. Finer control requires long calibration times or a light radiometer.

If the difference is greater than two RISTON steps, or greater accuracy is required, the integrators must be calibrated. Proceed with these instructions.

i. Calibration With New Exposure Lamps:

(1) Set both integrators at 100 counts.

(2) Adjust the appropriate integrator trimpot for each side of each frame to give a 20-second exposure (5 counts per second) on all four Turn the trimpots **clockwise** to **increase** the exposure times. Be certain that the correct exposure frame is in the Printer during each adjustment.

(3) Run sample panels at 5 kW with density step tablets on all four frame sides. Use the same procedures given for the first sample panels for identification, exposure, and development.

All four sides hould be within two RISTON steps; if they are not, readjust the appropriate integrator trimpots. A 10% change in the exposure time will change the exposure level about one step.

j. Calibration With Used Exposure Lamps:

(1) Note the exposure steps held on the four sides of the first sample panels. Determine which sides require adjustment to bring them to within two RISTON steps of the other sides.

(2) Adjust the appropriate integrator trimpot for the side of the frame that is out of balance. Be certain that the correct frame is in the Printer during each adjustment. Turn the trimpot **clockwise** to **increase** the exposure time (higher exposure step). A 10% change in the exposure time will change the exposure level about one RISTON step.

(3) Run new sample panels for all four frame sides. Hold the panels for 15 minutes before developing. Check the exposure steps held. If any side(s) is more than two RISTON steps different from the other sides, repeat steps 2 and 3 until all four sides are properly balanced.

k. **Phototools:** Phototools absorb varying amounts of light energy depending on the materials used and their quality. The operators must determine the integrator count settings required to compensate for any energy lost in the phototools used. That procedure is in Section III-E of this manual.

J. LAMP COOLING DAMPER ADJUSTMENT

The airflow rate from the exhaust blower affects the lamp operating temperature and performance. This rate is adjustable by opening or closing the dampers in the air ducts for the upper and lower lamps inside the Printer cabinet. An **accurate** temperture probe is required for this adjustment.

1. Allow the Printer to idle with the lamps at 2 kW for **one hour.**
2. Interlock equipped models only: Remove the power pack access door and use the special key to unlock and release the interlock bypass switch.
3. Turn off the integrator power switches and set the manual timer to zero to prevent starting an exposure during the adjustment procedure.
4. Open the right side access door.

WARNING

This procedure requires the side doors to be open with the exposure lamps on. Avoid looking at the light; the intense ultraviolet light can cause serious eye damage.

5. Remove the hole plug on the end of the upper lamp air duct (Figure V-17). Insert the temperature probe approximately 50 mm (2 inches) into the hole.

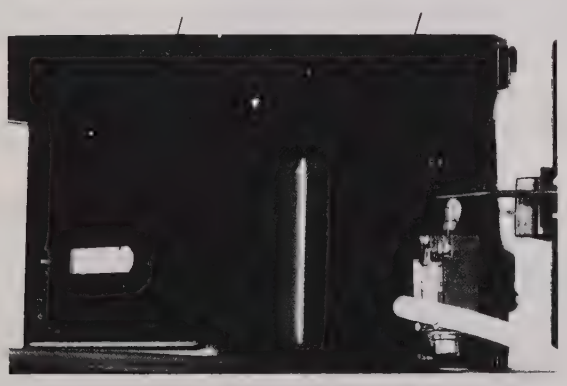


Figure V-17. Upper Lamp Air Duct — Test Hole Plug and Damper.

6. The air temperature in the duct should be 55°C to 60°C (131°F to 140°F). Refer to Figure V-17 and adjust the damper as necessary to set the air temperature.
   a. Loosen the lock nut on the damper.
   b. Move the damper about one-quarter inch for each adjustment. Close the damper to raise the air temperature.
   c. Wait five minutes after each adjustment before rechecking the air temperature.
   d. Repeat the adjustment until the air temperature is in the recommended range.
   e. Tighten the damper lock nut.
7. Repeat the damper adjustment procedure for the lower lamp air duct.

K. EXHAUST BLOWER BEARING REPLACEMENT

Du Pont does not stock replacement bearings for the blower motor. These bearings should be available from a local electrical motor repair shop.

1. Remove the blower housing to gain access to the impeller.
2. The impeller is epoxied to the motor shaft; it will be necessary to destroy it to disassemble the motor.
3. Break the impeller apart with pliers until only the metal hub remains on the motor shaft.
4. Remove the metal hub from the motor shaft with a gear puller. Clean the motor shaft with emory cloth to remove any residual epoxy adhesive.
5. Disassemble the motor to remove and replace the bearings.
6. A new impeller can be obtained from Du Pont spare parts. See Section VI — Parts. Epoxy the new impeller to the motor shaft after pressing it onto the shaft.
7. Replace the blower housing. Allow adequate curing time for the adhesive before operating the blower.

L. SHUTTER ASSEMBLY SERVICE

1. SHUTTER ASSEMBLY REMOVAL

If the upper and lower assemblies are removed from the Printer cabinet, label them so they will not be interchanged when replaced.

An extension cord (patch cord) is available to allow operation of the shutter assembly while it is outside the cabinet. See the Non-Illustrated Parts List in Section VI — Parts — for ordering information.

a. Disconnect the power and lock it out.

b. Open the side access doors and disconnect the shutter power cord (Figure V-18).

c. Loosen the wing nut on the shutter assembly's track stop (Figure V-19).

d. Slide the assembly out of the cabinet.

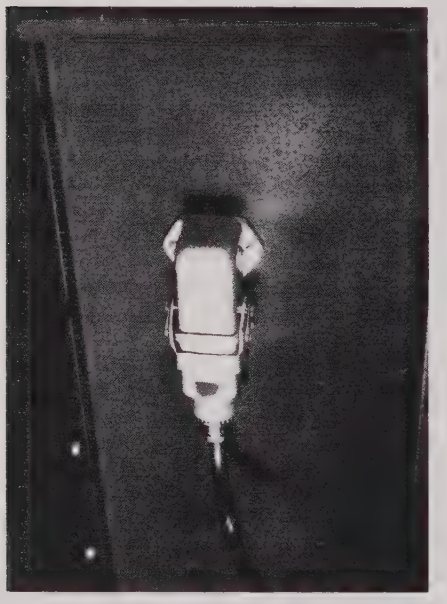


Figure V-18. Shutter Power Connector

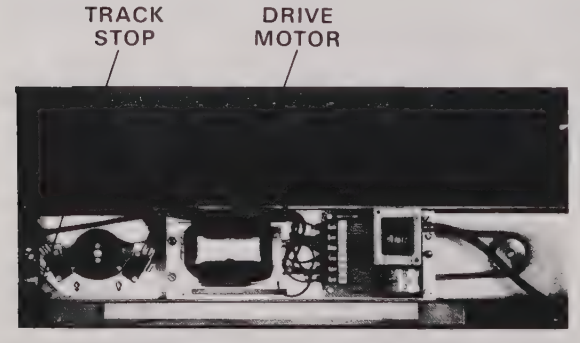


Figure V-19. Lamp Shutter Assembly

NOTE: If the shutters are to be operated out of the cabinet they should be positioned as they are in normal operation because of wear patterns in the hinges and bearings. The upper shutter should be suspended so the doors will swing open from the bottom.

2. SHUTTER DRIVE MOTOR REPLACEMENT

a. Turn off the power and lock it out.

b. Refer to Figure V-19 for the location of the shutter drive motor. Label the positions of the motor wires and remove them.

c. Remove the four screws attaching the drive motor to the frame and remove the motor.

d. Remove the nut and washer securing the chain sprocket to the splined motor shaft and remove the sprocket.

e. Remove the large nut on the motor shaft and the two smaller nuts attaching the motor to the adjusting plate.

f. Reverse the procedure to replace the motor and check the following:

(1) The shutter microswitch cam detent is aligned with the roller of the microswitch closest to the motor when the shutters are closed.

(2) The drive motor sprocket engages and tensions the chain by sliding the motor toward the shutter doors. Do not overtighten the chain — use moderate tension only.

3. SHUTTER MICROSWITCH ADJUSTMENT

The roller of the microswitch nearest the drive motor should be in the cam detent when the shutters are closed (Figure V-20). When the shutters are fully open, the opposite microswitch's roller should be in the detent. Adjust the position of the switch mounting bracket so the switches operate properly.

4. SHUTTER DRIVE IDLER SPROCKETS

There are two idler sprockets on each shutter assembly (Figure V-20). These are steel sprockets mounted on brass shafts. If the lubricant used on the idlers has dried, the sprockets may bind and cause erratic shutter operation. If the shutters are stiff or do not operate smoothly by hand, they should be disassembled and cleaned.

a. Remove the shutter assembly from the cabinet.

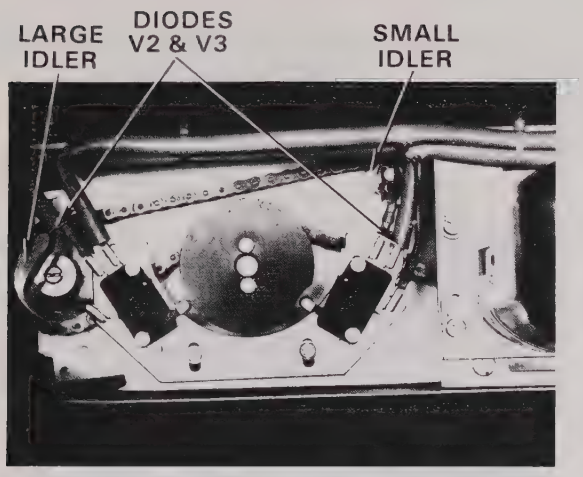


Figure V-20. Shutter Cam and Idler Sprockets

b. Loosen the screw in the center of the large sprocket. Remove the screw and thick washer.

c. Loosen the drive motor to slacken the chain; remove the motor if necessary.

d. Remove the screws attaching the large sprocket's mounting to the housing and remove the sprocket from the chain.

e. Remove the small idler sprocket by removing the cotter pin and sliding the sprocket off its shaft.

f. Clean the idler shafts and the bearing surfaces inside the sprockets. Lubricate the shafts with Teflon® or silicone spray lubricant.

g. Replace the sprockets and drive chain. If the large sprocket is worn, reattach its mounting plate upside down.

h. Be certain that both shutter doors are completely closed before and after retensioning the chain.

M. ELECTRICAL COMPONENT LOCATIONS & FUNCTIONS

1. FUSES

a. **Shutters:** Fuse F3 in each shutter circuit is located on the shutter pc board inside the Printer cabinet. Be certain that the power is turned off before removing or replacing these fuses.

b. **Integrators:** The two fuses for each integrator are located in fuse holders on the integrator face plates.

c. **Other Printer Circuits:** The fuses for all other Printer circuits are located at the top of the control panel (Figure V-21).

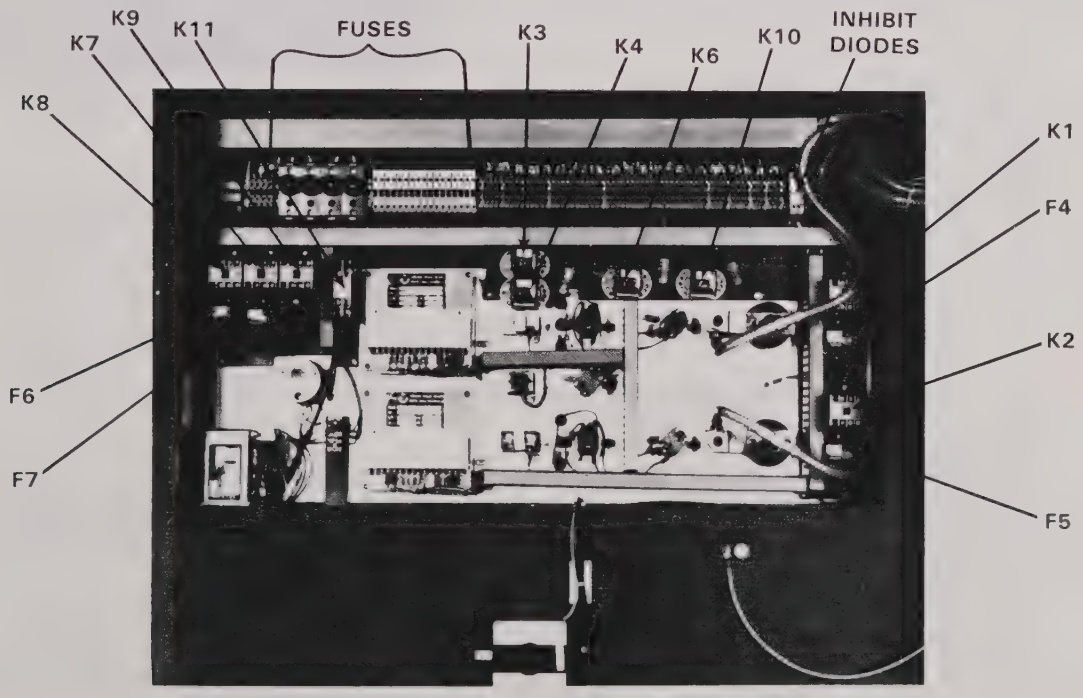


Figure V-21. Control Panel — Rear

The four fuses (1-F8 to 1-F11) are the 25-amp power pack fuses. The clear windows in the caps allow a visual check for blown fuses. Be certain that the large end of the fuse is put into the cap as shown in Figure V-22.

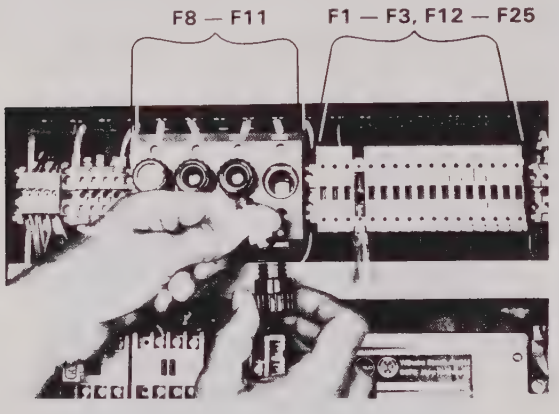


Figure V-22. Printer Fuse Locations

Fuses 1-F1 to 1-F3, and 1-F12 to 1-F-25 can be easily and safely replaced by pulling down on the top of the fuse holder (Figure V-22). Remove and replace these fuses from the right side of the holder.

2. EXHAUST BLOWER RELAYS AND CIRCUIT BREAKERS

Relays 1-K7, 1-K8, 1-K9, and 1-K11 for the two-speed exhaust blower are located at the left side of the control panel (Figure V-21). The circuit breaker overloads for K7 and K8 have variable settings and are pushbutton resettable.

Overload F7 for low-speed relay K7 has a range of 0.9 to 1.3 amps; it should bee set at 0.93 amps.

Overload F6 for high-speed relay K8 has a range of 1.3 to 1.6 amps; it should be set at 1.46 amps.

Relay K9 is used to short the low speed windings during high speed operation; it has no circuit breaker overload. Relay K11 is a one-second time delay relay to cut off power to the blower for one second between various speeds.

3. VACUUM PUMP RELAYS AND CIRCUIT BREAKERS

Relays 1-K1 (lower frame) and 1-K2 (upper frame) are located on the right side of the control panel as shown on Figure V-21. The circuit breaker overloads have variable settings and are pushbutton resettable. Both overloads should be set at 1.1 amps

4. SHUTTER CONTROL DIODES

a. Locations and Types

There are five diodes on each shutter assembly, V1 through V5. Refer to the electrical schematic in this manual to identify them in the upper shutter (3U) and the lower shutter (3L). Diodes V2 and V3 are type 1N 5062 located inside the wire covering at each of the shutter cam switches (Figure V-20) Diodes V4 and V5 are type 1N 5062 located on the shutter pc board (Figure V-23). Diode V1 is a bridge rectifier, Motorola Type MDA 204, located near V4 and V5 on the pc board

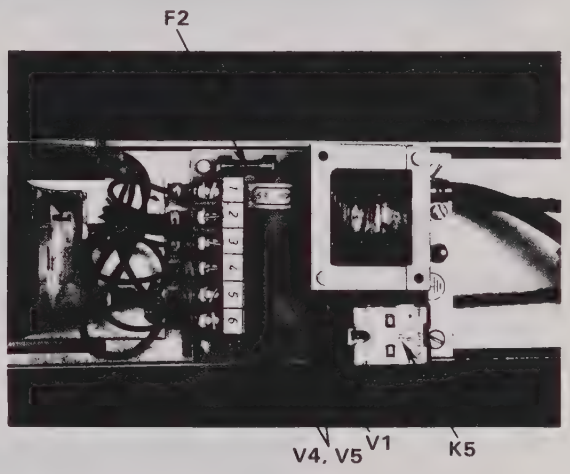


Figure V-23. Shutter PC Board

b. Troubleshooting: It is recommended that all other possibilities be checked before assuming there is a diode problem. Diodes can fail open or shorted but must be removed from the circuit for testing. Check the resistance across the diode, then reverse the meter leads; there should be high resistance in one direction and a low resistance in the other.

Diode	Fail Open	Fail Shorted
3U or 3L - V1	No power to motor	Transformer fails
3U or 3L - V2	Motor may overtravel	Shutter doesn't close
3U or 3L - V3	Motor may overtravel	Shutter doesn't open
3U or 3L - V4	Shutter doesn't open	V1 fails
3U or 3L - V5	Shutter doesn't close	V1 fails

5. REPEAT INHIBIT CIRCUIT

The repeat inhibit circuit prevents the restarting of an exposure when one or both integrators are operating. This prevents accidental overexposure of the resist.

a. **Component Locations:** The repeat inhibit circuit consists of three type 1N 5408 diodes (V1, V2, and V3) in an enclosure mounted on the control panel terminal strip, and relay K10 in the control panel (Figures V-21 and V-24).

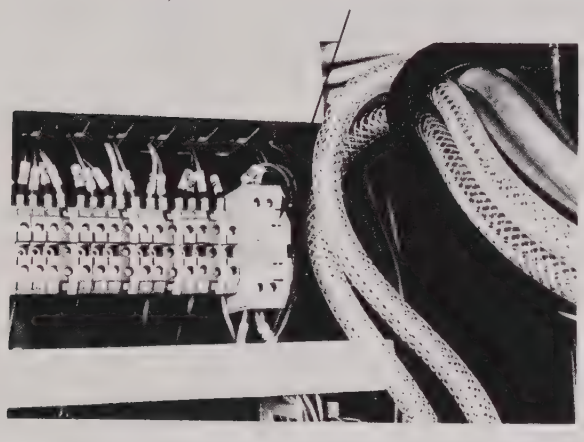


Figure V-24. Repeat Inhibit Circuit Diode Assembly

b. **Troubleshooting:** Diodes can fail open or shorted but must be removed from the circuit for testing. Check the resistance across the diode, then reverse the meter leads; there should be high resistance in one direction and a low resistance in the other. If the diodes fail open, the system is defeated; the operator can start a new exposure anytime during an exposure.

If the diodes fail shorted, the shutters for the integrator that counts out first will stay open until the other integrator counts out. This will cause an exposure imbalance form one side of the exposure frame to the other.

If the contacts stick on relay K10, the operator cannot start an exposure with the START button on the console. However, the START buttons on the integrators will start an exposure.

6. EXPOSURE FRAME ACTUATED SWITCHES

There are two roller switches mounted behind each exposure frame, and one roller switch mounted alongside the upper exposure frame, inside the Printer cabinet (Figure V-25). Ramps on the frames operate these switches.

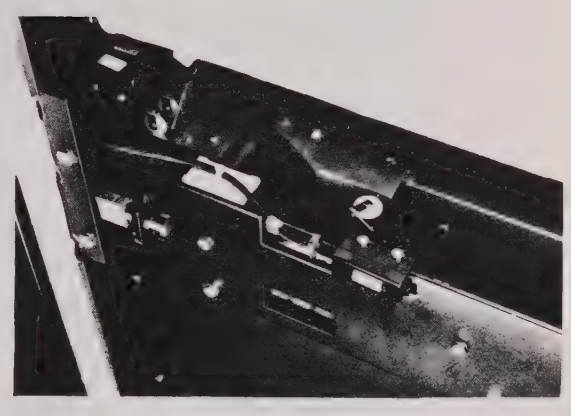


Figure V-25. Exposure Frame Switches (Upper Frame in Cabinet)

a. **Exposure Start Switches:** Switch S8 behind the upper frame and switch S9 behind the lower frame prevent the starting of an exposure unless the frame is fully into the cabinet.

b. **Vacuum Solenoid Switches:** Switch S3 behind the upper frame and switch S4 behind the lower frame operate the vacuum solenoid valve for the frame that is outside of the cabinet. These switches should be actuated when the outer frame is against the end of the frame track to release the frame vacuum. When the outer frame is pushed into the vacuum drawdown position, the inner frame should trip the switch to open the vacuum solenoid.

c. **Frame Selector Switch:** Switch S11 alongside the upper frame selects the integrator circuit for the frame being exposed. If this switch is damaged or defective, only the integrator circuits for the lower frame will be activated regardless of which frame is being exposed. This will cause problems with exposure imbalances on both sides of the upper frame; side 1 will be overexposed, side 2 will be underexposed.

N. TROUBLESHOOTING GUIDE

The following troubleshooting guide lists problems which may be encountered during Printer use. For each symptom, probable causes and solutions are offered to simplify troubleshooting.

WARNING

When possible, lock out the power supply before servicing the Printer to prevent others from powering the unit. Some items require opening of the Printer cabinet with the lamps on; use extreme caution to avoid burns, electrical shock, and exposure to the intense ultraviolet light.

TROUBLESHOOTING GUIDE

SYMPTOM	PROBABLE CAUSE	SOLUTION
No Printer function will operate.	1. Main power switch off.	1. Turn on power switch.
	2. No power to transformer.	2. Turn on power disconnect. Check for blown fuses or tripped circuit breakers.
	3. Control circuit fuses blown. (Frame cooling fan and illuminated table will function).	3. Check and replace fuses 1-F1, 1-F2, 1-F3 in control panel.
	4. Loss of one phase of power.	4. Check voltage between all three phases at transformer or disconnect; correct cause.
Neither exposure lamp will operate.	1. Access door/panel open. (Interlock-equipped units)	1. Close and latch all access panels.
	2. Lamps recently turned off; in cool-down period.	2. Lamps will ignite after sufficient cool-down.
	3. Low voltage to Printer.	3. Check voltage in and out of transformer.
One exposure lamp will not operate.	1. Lamp overheated.	1. Find cause and correct: a. Exhaust blower not operating/ operating in low speed only/ running backwards. b. Blower overloads tripped (in control panel). c. Lamp air intake restricted. d. Lamp air exhaust restricted. e. Cooling air damper closed.
	2. Lamp fuse blown.	2. Check and replace fuses F8, F9 (lower lamp) or F10, F11 (upper lamp) in control panel.
	3. Lamp ignition circuit.	3. Check all power pack components.
	4. Lamp power switch.	4. Replace or repair switch.
	5. Defective lamp.	5. Replace lamp.
	6. Loss of one phase of power.	6. Check voltage between all three phases at transformer or disconnect; correct cause.

SYMPTOM	PROBABLE CAUSE	SOLUTION
Shutter will not open or close.	1. Exposure frame not fully into cabinet.	1. Outer frame must be out as far as vacuum drawdown position.
	2. Exposure microswitch behind frame is broken or misadjusted.	2. Adjust or replace switch.
	3. Blown fuse on shutter pc board.	3. Find cause and replace 1¼ amp fuse.
	4. Shutter cam microswitches misadjusted or defective.	4. Adjust or replace switches.
	5. Shutter circuit diodes.	5. Check and replace diodes V-1, V-4, and V-5 on shutter pc board; diodes V-2 and V-3 on cam switch leads.
	6. Exposure start switch.	6. Use start switch on integrator to test; replace switch if shutter operates.
	7. Shutter drive motor.	7. Test for power to motor; repair or replace motor.
	8. Integrator problem.	8. Use manual timer to test; if shutter opens, replace integrator.
	9. Repeat inhibit circuit.	9. Check and replace diodes 1-V1, 1-V2, and 1-V3 in control panel. Check operation of relay 1-K10 in control panel; repair or replace.
	10. Exposure start relay.	10. Check operation of relay 1-K4 in control panel; repair or replace.
	11. Shutter relay.	11. Check operation of relay K5 on shutter pc board; repair or replace.
	12. Idler sprocket(s) binding.	12. Clean and lubricate idlers.
No display on integrator.	1. Lamp not on, or is in five-minute ignition cycle.	1. Turn lamp on. Integrator will light after five minutes.
	2. Integrator problem.	2a. Turn integrator switch on. 2b. Check integrator fuses. 2c. Interchange integrators to check function.
One integrator counts much faster than the other.	1. One lamp is much older than	1. Check lamp intensities; replace lamps in pairs when practical.
	2. Integrator calibration.	2. Check exposure balance and recalibrate integrators.
	3. Lamp operating at 2kW only. Contactor K3 problem.	3. Check contactor operation; replace.

SYMPTOM	PROBABLE CAUSE	SOLUTION
One integrator counts much faster than the other. (cont'd.)	4. One lamp overcooled.	4. Adjust lamp cooling air exhaust temperature. See Section V—Service.
	5. Photodetector problem.	5. Check integrator operation with both exposure frames to verify; replace photodetector.
Lamp does not operate at 5kW intensity.	1. Intensity selector switch.	1. Replace switch.
	2. Power selection contactor K3.	2. Check contactor operation; replace.
	3. Faulty lamp choke.	3. Replace choke L2.
Sudden frame-to-frame exposure imbalance.	1. Improperly processed phototools.	1. Check exposure balance without phototools. Reprocess phototools.
	2. Integrator circuit selector switch S11 (on side frame) not actuated.	2. Check for positive switch actuation by upper frame; adjust switch.
	3. Both shutters closing at same time — inhibit circuit problem.	3. Check and replace inhibit circuit diodes (1N 5408).
Frequent frame-to-frame exposure imbalances.	1. Low voltage to Printer.	1. Correct transformer output voltage — minimum of 380V required.
	2. Improperly processed phototools.	2. Check exposure balance without phototools. Reprocess phototools.
	3. Integrator circuit selector switch S11 (on side frame) not actuated.	3. Check for positive switch actuation by upper frame; adjust switch.
	4. Shutters not always opening fully.	4. Check shutter chain tension and microswitch adjustment.
	5. Photodetector sensitivity loss.	5. Replace photodetector.
Exposure imbalance across frame.	1. Broken ceramic insulators on lamp bracket.	1. Replace insulators.
	2. Lamp focus out of adjustment.	2. **Critical adjustment** - contact your RISTON® Service Representative.
Short exposure lamp life.	1. Lamp overcooled.	1. Adjust lamp cooling air exhaust temperature — see Section V—Service.
	2. Lamps not cleaned.	2. Clean fingerprints from lamps with alcohol-wetted cloth after installation or maintenance.
	3. Too frequent lamp start-ups.	3. Do not shut off lamps for short periods; operate at least four hours per start-up.

TROUBLESHOOTING GUIDE (Continued)

SYMPTOM	PROBABLE CAUSE	SOLUTION
Exposure lamp(s) extinguish during operation.	1. Printer access door open. (Interlock equipped models)	1. Close all access door. Use interlock bypass key if necessary for service.
	2. Lamp overheated; thermoswitch tripped.	2a. Exhaust damper locking screw loose — readjust and tighten. 2b. Exhaust damper not adjusted properly — readjust. 2c. Exhaust system problem — see next symptom.
	3. Faulty thermoswitch.	3. Check at power pack terminals 21 and 22 with lamp cool. Replace thermoswitch if open.
	4. Faulty lamp.	4. Replace lamp.
Exhaust blower output low or off.	1. Blower operating on one speed only.	1a. Check operation of contactors K7, K8, K9. Reset overload of K7 or K8. 1b. Check fuses F12 through F17. Find cause before replacing fuse.
	2. Lamp cooling air damper.	2. Adjust lamp cooling air exhaust temperature — see Section V—Service.
	3. Lamp cooling air intake or exhaust duct restriction.	3. Correct any ducting restriction or back pressure problem. Do not use filters in ducting.
	4. Blower impeller dirty.	4. Remove blower housing and clean impeller.
	5. Blower operating in reverse direction.	5. Correct power phasing at blower see Section II-F-4.
No vacuum to one or both exposure frames. (Also refer to the vacuum pump trouble-shooting guide).	1. Vacuum pump not operating.	1. Check vacuum pump switch, fuses (F18-F23), and overload. Check for power to pump; replace if necessary.
	2. Exposure frame not pushed in to drawdown position.	2. Move frame forward to drawdown position.
	3. Vacuum solenoid actuation switch behind frame.	3. Adjust switch actuation.
	4. Pinched vacuum hose.	4. Correct or replace hose.
	5. Vacuum pump overload tripped.	5. Correct cause and reset overload.
	6. Vacuum solenoid valve sticking.	6. Repair or replace valve.

TROUBLESHOOTING GUIDE (Continued)

SYMPTOM	PROBABLE CAUSE	SOLUTION
Low vacuum to one or both exposure frames. (Also refer to the vacuum pump trouble-shooting guide).	1. Vacuum level adjustment.	1. Adjust vacuum bleed valve to highest level.
	2. Hole in frame cover sheet.	2. Replace MYLAR® film cover sheet.
	3. Defective frame seal.	3. Replace frame seal.
	4. Collapsed, damaged, or pinched vacuum hose.	4. Correct or replace hose.
	5. Worn vacuum pump.	5. Repair or replace pump. Maintain pump as recommended in Section IV.

VACUUM PUMP TROUBLESHOOTING GUIDE

Oil discharge from muffler vent.	1. Pump operated with no/low load — high air flow through pump.	1. Pumps must draw against closed frame or solenoid. Adjust vacuum bleed to highest level.
	2. Oil separator cartridge seals loose or not aligned.	2. Align seals; tighten bottom bolt.
	3. Oil return line plugged.	3. Clean return line.
	4. Oil separator cartridge plugged.	4. Replace cartridge*.
Oil puddle under pump.	1. Motor shaft seal worn.	1. Replace shaft seal.
Low vacuum.	1. Low oil level.	1. Fill to brim of fill plug. Check weekly.
	2. Metal sponge filter plugged.	2. Replace filter.
	3. Oil separator cartridge plugged.	3. Replace cartridge*.
	4. Paper filter plugged.	4. Clean or replace filter.
	5. Oil suction line plugged.	5. Clean suction line.
	6. Oil breakdown.	6. Disassemble, clean and refill pump with new oil.
Pump does not operate.	1. Overload tripped.	1. Find cause and reset.
	2. Motor defective.	2. Replace pump.

***Replace oil separator cartridge every 1000 operating hours; 500 hours if operating below 70% vacuum.**

VI. PARTS

RISTON® PC-130 PRINTER

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HOW TO USE THE PARTS SECTION

LOCATING PARTS

Use the table of contents on the previous page to find the figure where the particular assembly or piece of equipment is illustrated. Note the item number given for the part in the figure, then refer to the applicable parts list to find the associated Du Pont part number, item description, and quantity required for each item.

FIGURE/ITEM NUMBER

The item number for parts illustrated in each figure applies only to the unit illustrated and should not be used as a cross-reference from one parts list to another.

CIRCLED ITEM NUMBERS

Circled item numbers on the figures denote assemblies which contain two or more parts. Refer to the parts list to determine the actual parts breakdown of the assembly.

DESCRIPTION

The relationship of a part to its next higher assembly is indicated by the number of dots directly preceding it:

- ● Assemblies and detail parts of unit.
- ●● Subassemblies or attaching parts of assemblies.
- ●●●Detail or component parts of subassemblies.

NOTE: **The part description may also reference the function and/or schematic code for the part. This information, if supplied, will be enclosed in brackets [ ].**

REQUIRED QUANTITIES

The quantity shown for an assembly or detail part of the unit (●) indicates the number per machine in the use described.

The quantity shown for a subassembly or attaching part of an assembly (●●) indicates the number used per assembly (●).

The quantity shown for a detail or component part of a subassembly (●●●) indicates the number used per subassembly (●●).

Example:

	Description	Qty.
●	Shutter, Complete Assembly	2 (per printer)
●●	PC Board Assy., Shutter	1 (per Shutter Assy.)
●●●	Diode 1N 5062	2 (per PC Board Assy.)

An "AR" in the Quantity column denotes "As Required."

PARTS AVAILABILITY

Item numbers followed by an asterisk (*) in the parts list refer to parts normally stocked by Du Pont. All other parts can be obtained from Du Pont only on a special order basis and will require up to six months for delivery.

COMMON HARDWARE

Most of the fasteners and other common hardware used in this equipment are not shown in the parts list. These items are generally available locally. All fasteners are metric sizes.

ADDITIONAL LISTS

Four additional lists are provided at the end of this section for convenient reference: Non-Illustrated Parts, Accessories, Recommended Spare Parts, and a Numerical Index.

NUMERICAL INDEX

The numerical index is for use when only the Du Pont part number is known. The part numbers are listed in sequence, followed by the Figure/Item numbers needed to locate them in the parts lists.

ORDERING PARTS

When ordering parts, give the name of the equipment, part number, complete description, equipment serial number, and date of installation. Mail or phone purchase order to nearest Du Pont RISTON® Products Division, Parts Department.

United States

- Midwest
  7415 N. Melvina Avenue
  Niles, IL 60648
  (312) 647-7887

- Northeast
  380 Allwood Road
  Clifton, NJ 07012
  (201) 473-4004

- Southeast
  P.O. Box 80368
  3070 NE Expressway
  Atlanta/Chamblee, GA 30341
  (404) 455-7800

- Southwest
  P.O. Box 5006
  1600 Hurd Drive
  Irving, TX 75062
  (214) 258-1636

- West
  3300 Pacific Avenue
  Burbank, CA 91505
  (213) 843-1612

Canada

- Du Pont of Canada
  Du Pont of Canada Limited
  115 Idema Road
  Markham, Ontario, Canada L3R 1A9

International

(Other Than Europe)

- International Operations Division
  Concord Plaza — Wilson Bldg.
  Wilmington, DE 19898

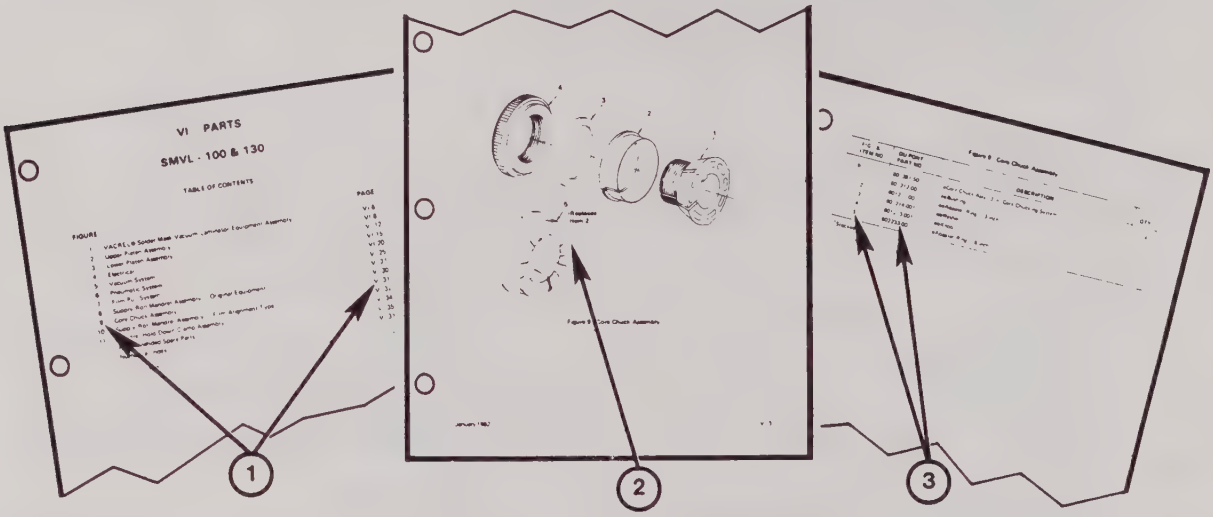
  Cable: Du Pont Film Wilmington

  Texex: 835420 or 835425

  TWX: 5106662954

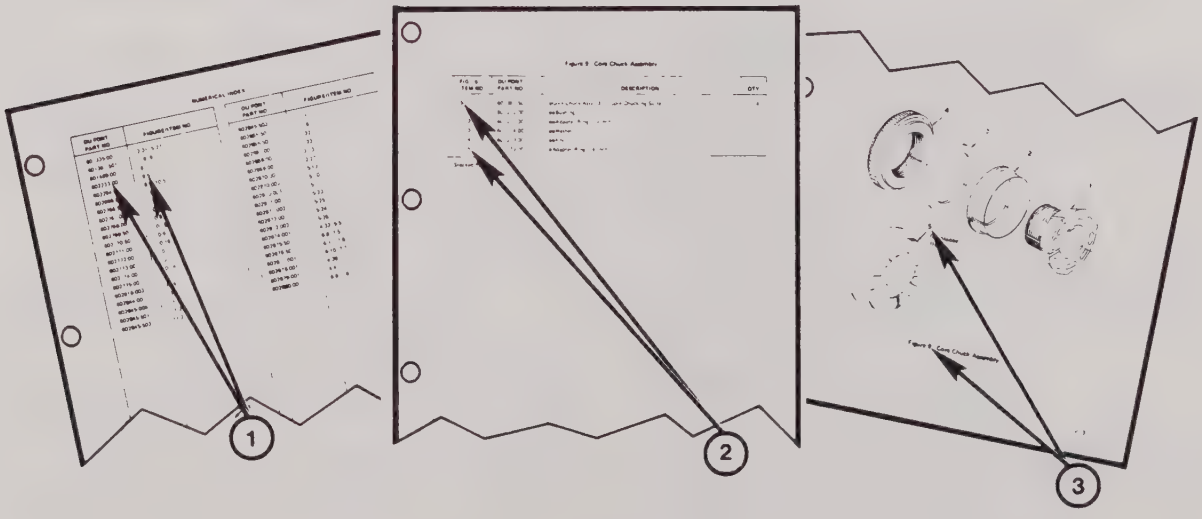
HOW TO USE THE ILLUSTRATED PARTS BREAKDOWN

WHEN THE PART NUMBER IS NOT KNOWN



1. Find appropriate title in index and note illustration page number.
2. Turn to page and find part and its item number.
3. Locate the item number in parts list and find part number.

WHEN THE PART NUMBER IS KNOWN



1. Turn to Numerical Index and find part number. Note figure and item number.
2. Turn to figure number and locate item number.
3. Refer to item number on illustration for graphic representation of part.

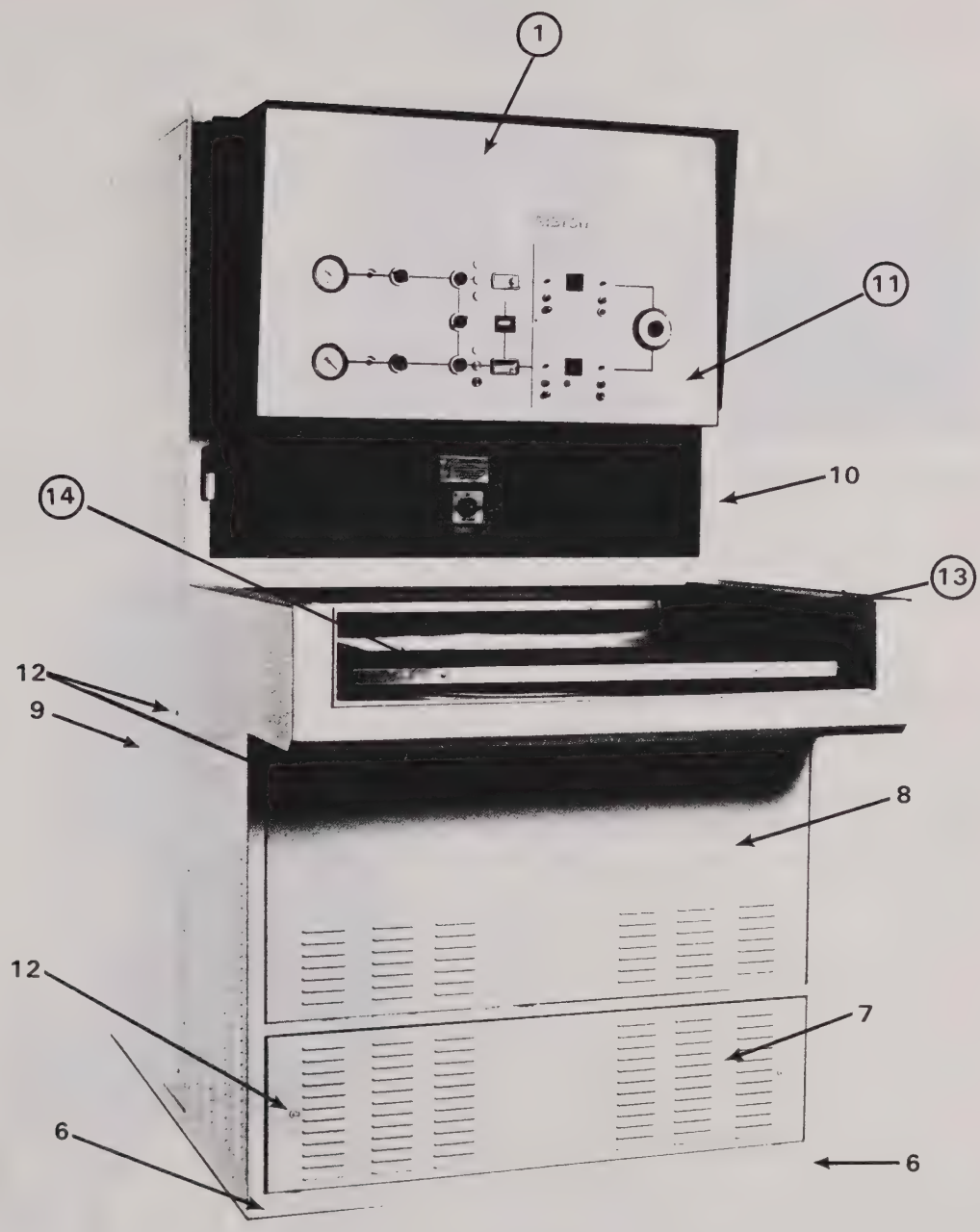


Figure 1a. PC-130 Printer Equipment Assembly

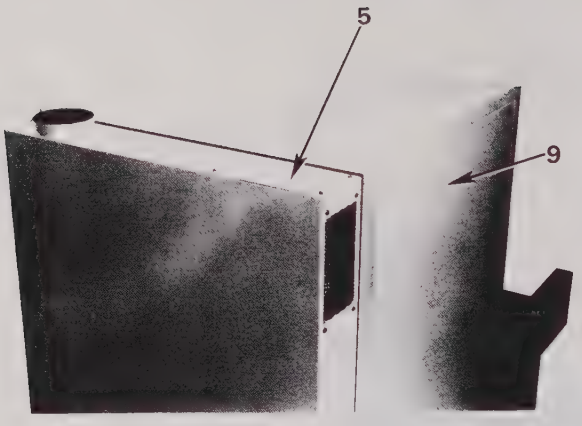


Figure 1b. PC-130 Printer Equipment Assembly (Rear View)

Figure 1c. PC-130 Printer Equipment Assembly (Rear View with Air Intake Adapter Installed)

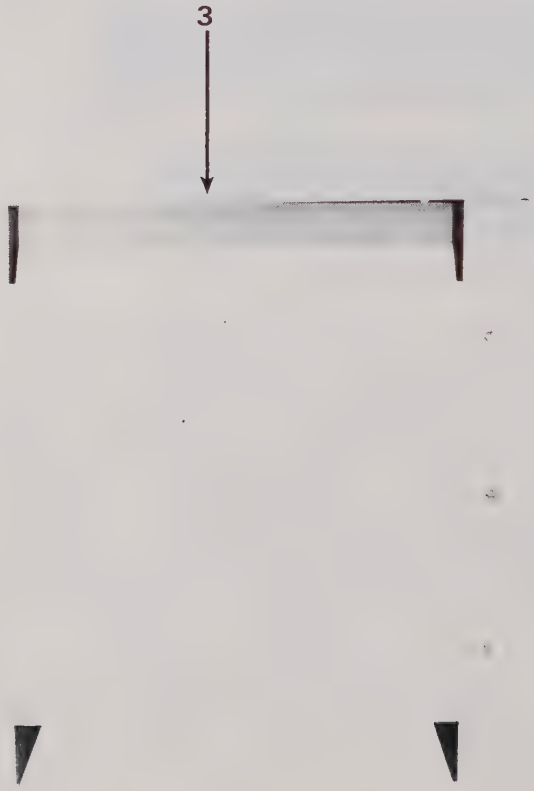


Figure 1d. PC-130 Equipment Assembly (Transformer)

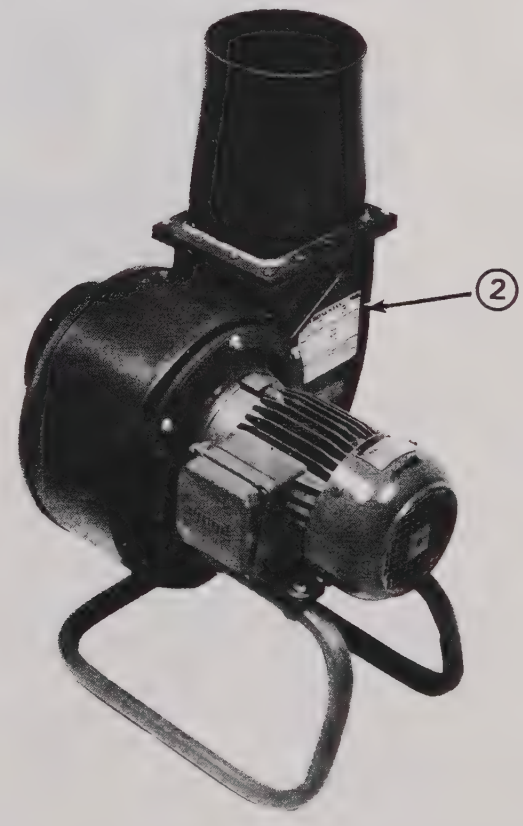


Figure 1e. PC-130 Printer Equipment Assembly (Two-Speed Exhaust Blower)

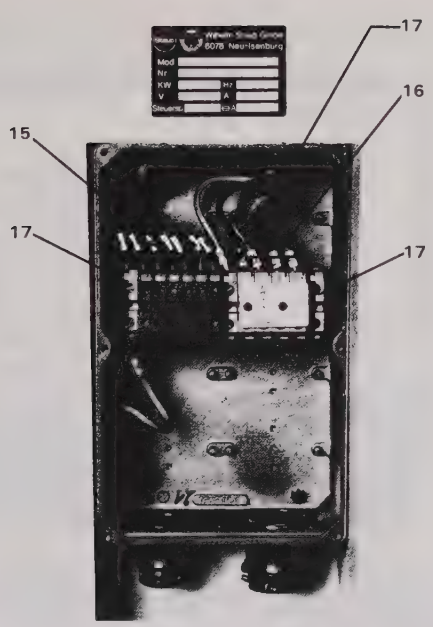


Figure 1f. PC-130 Printer Equipment Assembly (Printer Electrical Junction Box)

FIGURE 1. RISTON® PC-130 PRINTER EQUIPMENT ASSEMBLY

FIG. 1/ ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
1- 1		PC-130 Printer Equipment Assy.	1
2*		• Blower, Exhaust, Two-Speed (See Figure 11 for breakdown)	1
3*	280003-001	•Transformer, Multi-Tap; 190V - 240V & 400V - 480V, 50/60 Hz Input	1
–*	280003-002	•Transformer, Multi-Tap, Nominal 346V, 50 Hz Input	1
4*	602934-001	•Adapter, Lamp Cooling Air Intake	1
5	603035-001	•Plate, Cover, Lamp Air Intake	1
6*	280641-001	•Plate, Leveling (Adjusting Foot)	4
7	602452-505	•Door, Access, Vacuum Pump	1
8	602452-504	•Door, Access, Power Pack	1
9	602450-504	•Door, Access, Left Side	1
10	602451-504	•Door Access, Right Side	1
11		•Control Panel, PC-130 (See Figs. 2 & 3 for breakdown)	1
12*	602691-001	•Latch, Access Door (Used on Items 7 to 11)	15
13		•Exposure Frame Assy. (See Fig. 4 for breakdown)	2
14		•Illuminated Table (See Fig. 2 for breakdown)	1
15	280592-006	•Terminal Block, Blower Output, Weidmuller SAK 6 N	6
16	601863-001	•Terminal Block, Main Power, Weidmuller SAK 10	4
17	280591-004	•Terminal Block, Ground, Weidmuller EK 10	3

*Stocked Part

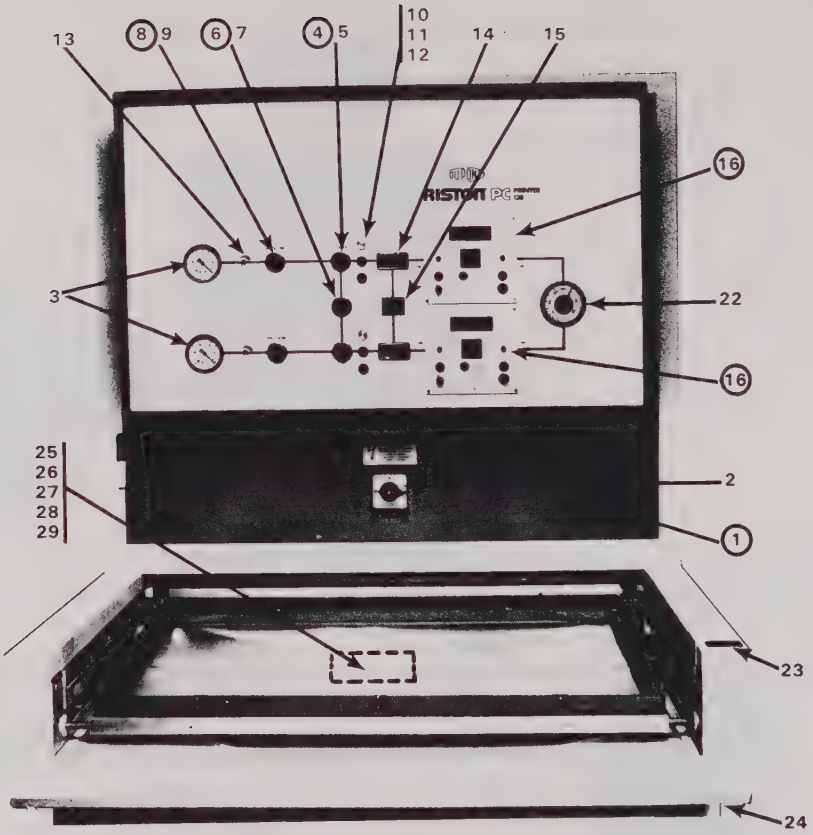


Figure 2a. Control Panel — Front

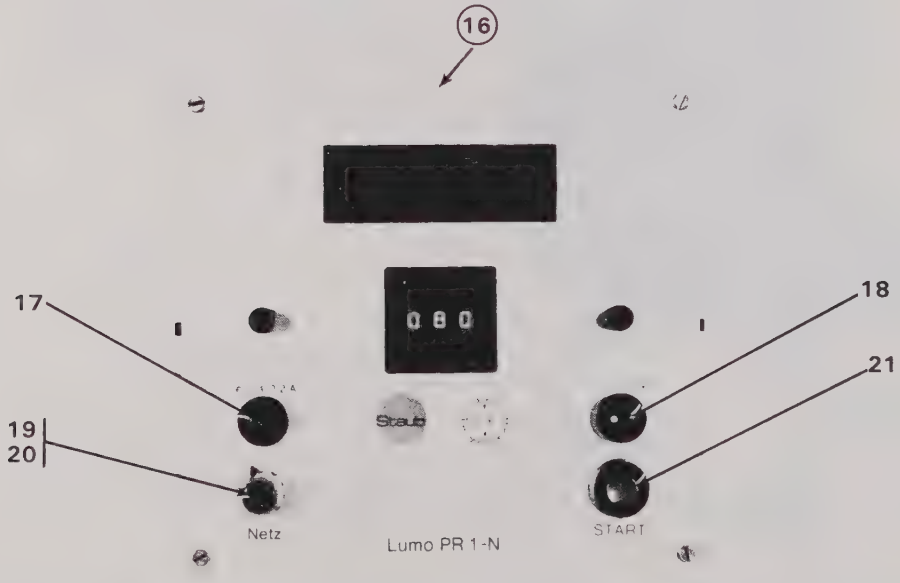


Figure 2b. Control Panel — Front (Integrator)

FIGURE 2. CONTROL PANEL — FRONT

FIG. 2/ ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
2- 1	602692-504	•Control Panel Assy., PC-130, 60 Hz	1
–	602692-505	•Control Panel Assy., PC-130, 50 Hz	1
2*	601424-001	••Switch, Main Power	1
3*	601459-001	••Gauge, Vacuum	2
4*	280946-001	••Switch, Selector, Momentary Contact [Lamp Ignition, S/N 477 & Up]	2
–*	602891-001	••Switch, Momentary Contact [Lamp Ignition, S/N 476 & Lower]	2
5*	601428-001	•••Bulb, Switch Illuminating	1
6*	280947-001	••Switch, Selector, Maintained Contact [Intensity, S/N 477 & Up]	1
–*	601431-001	••Switch, Ratcheting, On/Off [Intensity, S/N 476 & Lower]	1
7*	601428-001	•••Bulb, Switch Illuminating	1
8*	281014-001	••Switch, Selector, Rotary [Vacuum Pump, S/N 477 & Up]	2
–*	601431-001	••Switch, Ratcheting, On/Off [Vacuum Pump, S/N 476 & Lower]	2
9*	601428-001	•••Bulb, Switch Illuminating	1
10*	601425-001	••Pilot Lamp, Clear Lens [Lamp Power, S/N 477 & Up]	2
11*	281035-001	••Pilot Lamp, Blue Lens [Lamp Ignition, S/N 477 & Up]	2
–*	601427-001	••Pilot Lamp, Amber Lens [Lamp Ignition, S/N 476 & Lower]	2
12*	601426-001	••Pilot Lamp, Green Lens [Lamp Ready, All PC-130]	2
13*	602889-001	••Valve, Vacuum Adjustment	2
14*	601455-001	••Hourmeter, Lamp, 60 Hz	2
–	601455-002	••Hourmeter, Lamp, 50 Hz	2
15*	601441-001	••Counter, Copy, 50/60 Hz	1
16*	601438-005	••Integrator, Exposure Control (Orig. Equip. Type, see Accessories list for Millijoule Integrator breakdown)	2
17*	275770-005	•••Fuse, 2/10 amp	1
18*	275770-014	•••Fuse, 2 amp	1
19*	280726-001	•••Switch, Integrator (On/Off)	1
20*	280944-001	•••Knob, Integrator (On/Off Switch)	1
21*	280727-001	•••Switch, Integrator (Start)	1
22*	601440-001	••Timer, Auxiliary Exposure, 60 Hz	1
–*	601440-002	••Timer, Auxiliary Exposure, 50 Hz	1
23*	601467-001	••Pushbutton, Exposure Start	1
24*	601466-001	••Switch, Illuminated Table	1
25*	601419-001	••Lamp, Fluorescent, 220V, Illuminated Table	2
26	280652-001	••Socket, Fluorescent Lamp	4
27*	601420-001	••Choke, Illuminated Table, 60 Hz	2
–	601420-002	••Choke, Illuminated Table, 50 Hz	2
28*	601421-001	••Starter, Lamp, Illuminated Table, 50/60 Hz	2
29*	602040-002	••Tray, Yellow Plastic, Illuminated Table	1

*Stocked Part

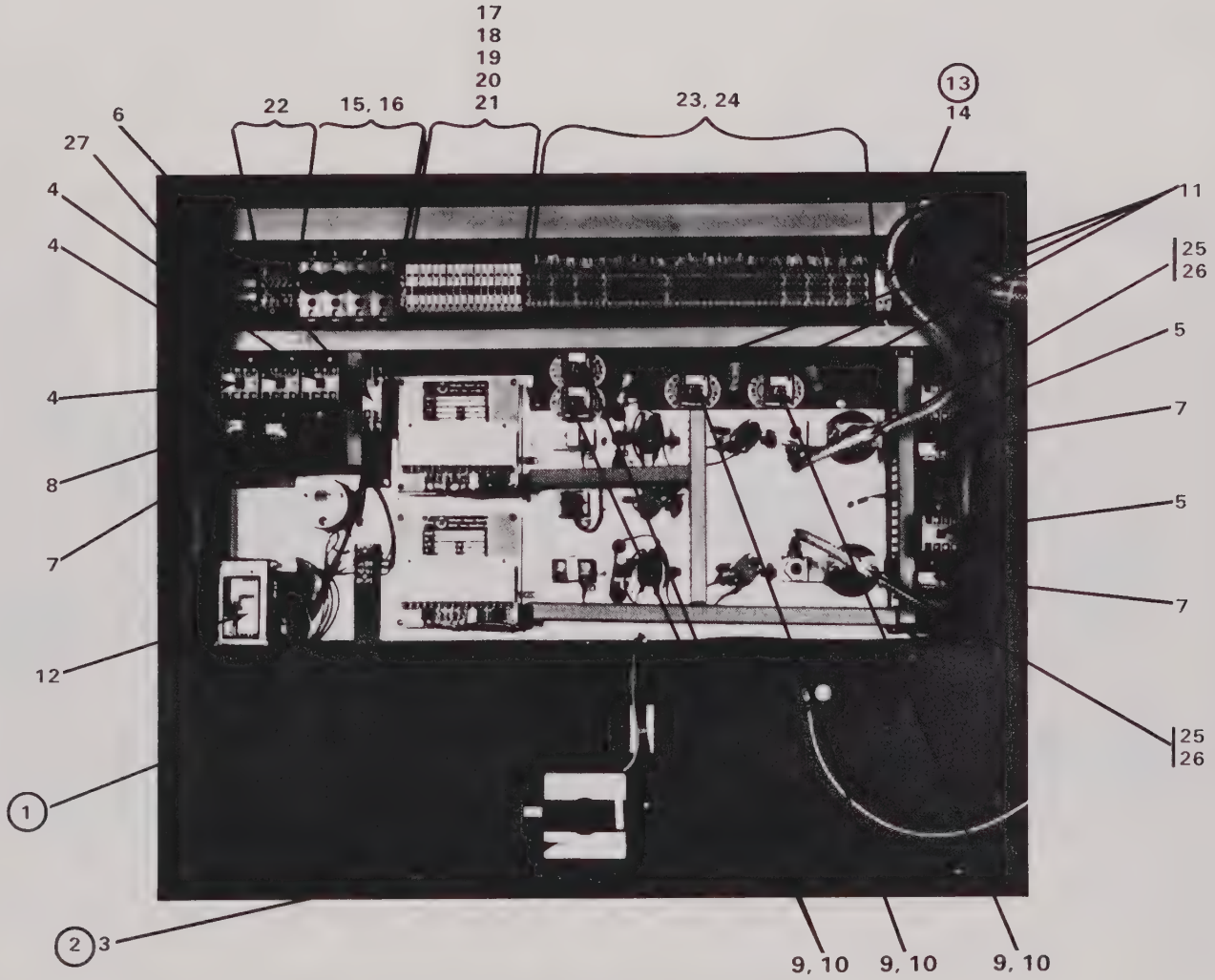


Figure 3. Control Panel — Rear

FIGURE 3. CONTROL PANEL — REAR (ALSO SEE FIGURE 2)

FIG. 3/ ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
3- 1	602692-504	•Control Panel Assy., PC-130, 60 Hz	1
—		•Control Panel Assy., PC-130, 50 Hz	1
2*	601424-001	••Switch, Main Power	1
3*	280537-001	•••Cover, Terminal, Main Power Switch	2
4*	601461-001	••Relay, Two-Speed Blower, 50/60 Hz [K7, K8, K9]	3
5*	601461-001	••Relay, Vacuum Pump, 50/60 Hz [K1, K2]	2
6*	602900-001	••Relay, Timer, 0 - 10 Sec., Two-Speed Blower [K11]	1
7*	601462-001	••Overload, Circuit Breaker, 50/60 Hz, 0.9 - 1.3 amp, [F4, F5, F7] (S/N 611 & Lower)	3
—*	601462-004	••Overload, Circuit Breaker, 50/60 Hz, 0.9 - 1.3 amp, [F4, F5, F7] (S/N 612 & Up)	3
8*	601462-002	••Overload, Circuit Breaker, 50/60 Hz, 1.3 - 1.8 amp, [F6] (S/N 611 & Lower)	1
—*	601462-003	••Overload, Circuit Breaker, 50/60 Hz, 1.3 - 1.8 amp, [F6] (S/N 612 & Up)	1
9*	601439-001	••Relay [K4-Start, K6-Aux. Timer, K10-Repeat Inhibit: All PC-130; K3-Side Door Interlock on S/N 477 & Up]	4
10	280943-001	••Base, Relay, Plug-In	4
11*	281006-001	••Capacitor, 0.1 MFD, 250 VAC	3
12*	602943-001	••Transformer, Control Voltage, 380V/220V, 300 VA	1
13*	602899-501	••Diode Assy. [Inhibit Circuit]	1
14*	601888-002	•••Diode, 1N 5408	3
15*	602892-001	••Fuse Block, Weidmuller SAKS 5 [Power Pack Protection]	4
16*	602894-001	••Fuse, 25 amp, Weidmuller 3614.0 [F8 - F11]	4
17*	602893-001	••Fuse Block, Weidmuller ASK1	17
18*	275770-001	••Fuse, 1 amp, Littlefuse No. 211001 [F3]	1
19*	275770-014	••Fuse, 2 amp, Littlefuse No. 211002 [F1, F2]	2
20*	275770-016	••Fuse, 4 amp, Littlefuse No. 211004 [F12 - F21]	12
21*	601430-001	••Fuse, 6.3 amp [F24, F25]	2
22*	601863-001	••Terminal Block, Weidmuller SAK 10	4
23*	601886-001	••Terminal Block, Weidmuller SAK 4	50
24	280591-003	••Terminal Block, Ground, Weidmuller EK 4	10
25*	280942-004	••Tee, Barbed, Vacuum Hose	2
26*	601878-002	••Hose, Vacuum, Reinforced, 8 mm ID x 3 mm Wall x 15 meters long	A/R
27*	602691-001	••Latch, Access Door (Control Panel Latch)	1

*Stocked Part

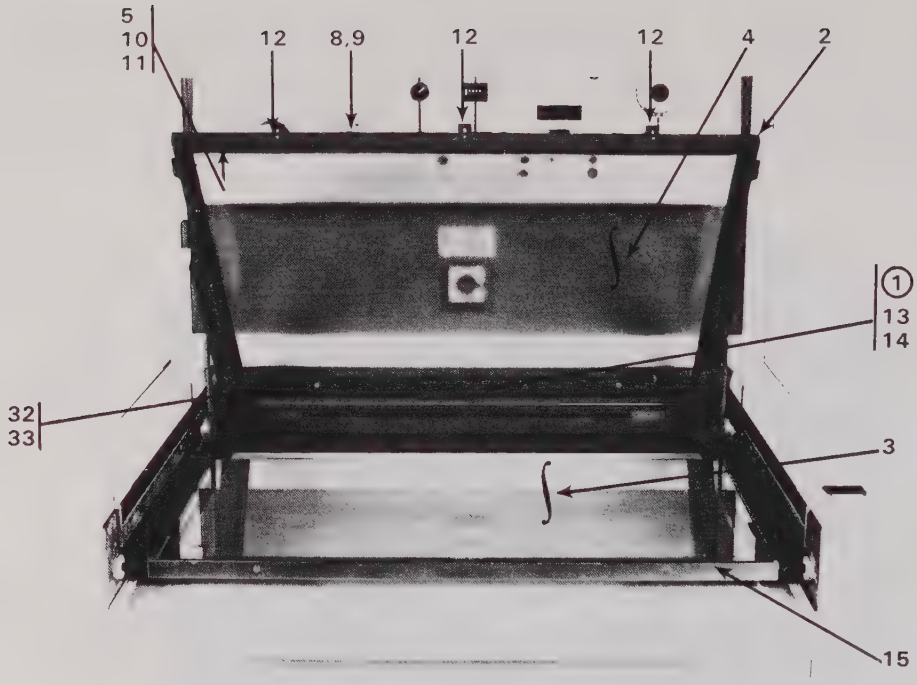


Figure 4a. Exposure Frame Assembly

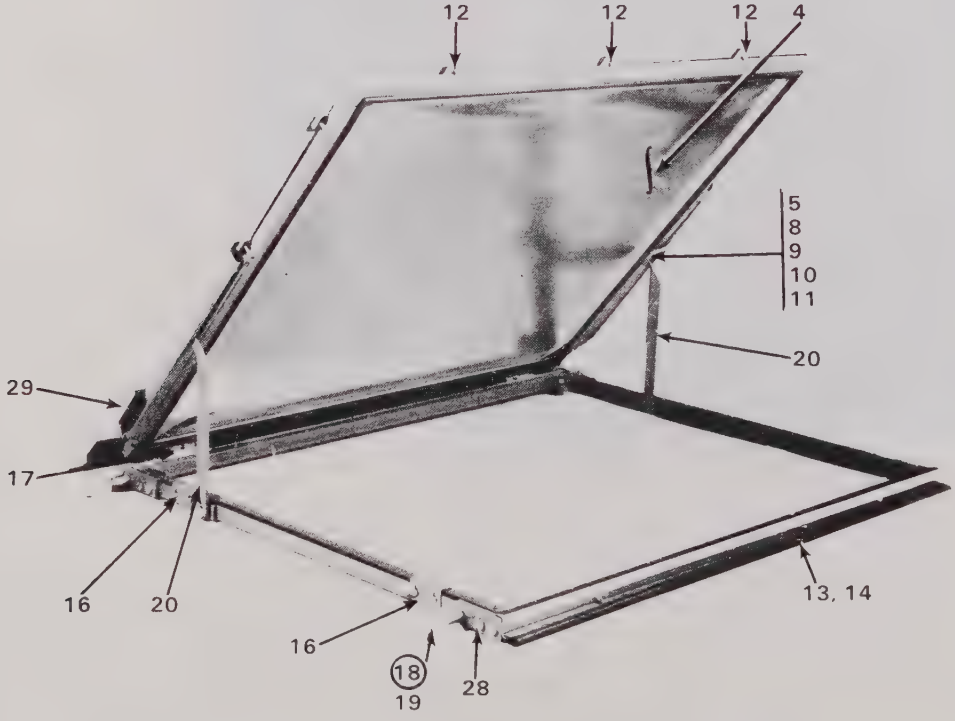


Figure 4b. Exposure Frame Assembly (Upper Frame Shown)

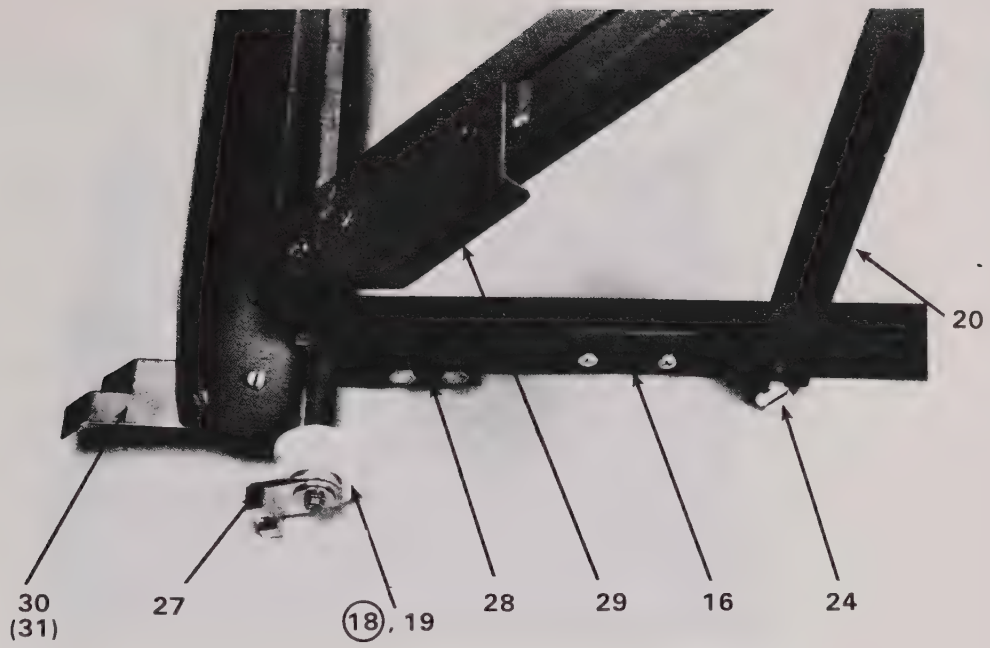


Figure 4c. Exposure Frame Assembly — Left Rear Corner (Upper Frame Shown)

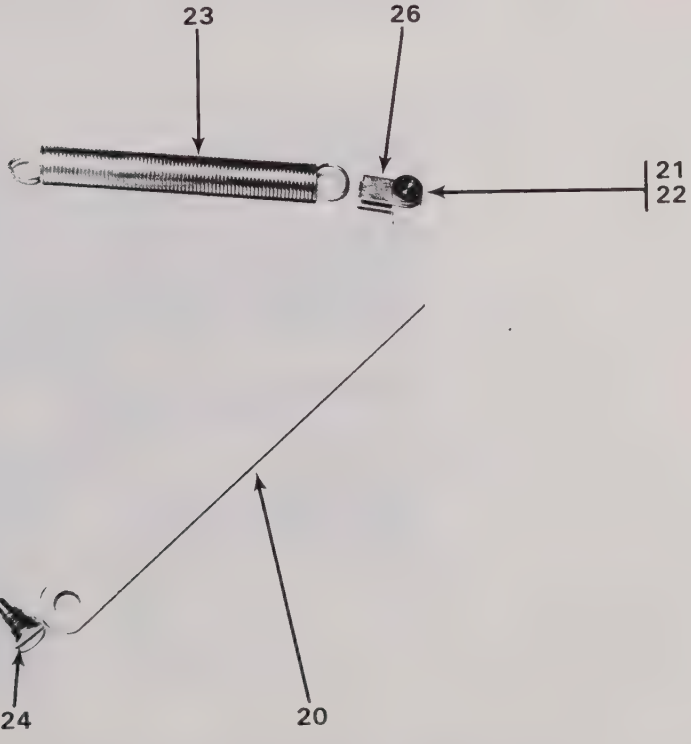


Figure 4d. Exposure Frame Assembly — Support Arm

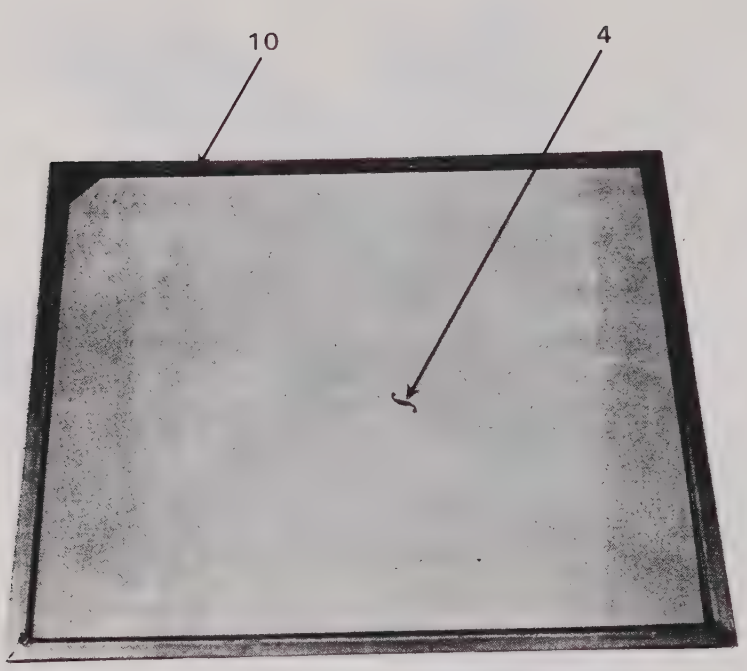


Figure 4e. Exposure Frame Assembly — Vacuum Channel (Inverted)

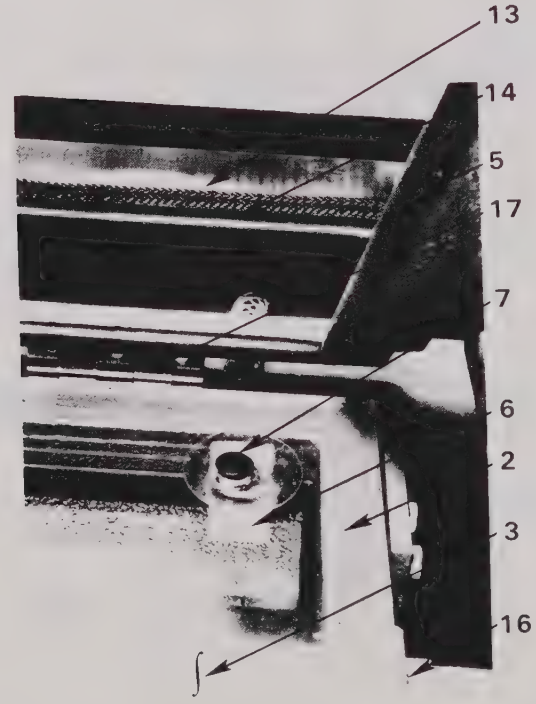


Figure 4f. Exposure Frame Assembly — Vacuum Connection (Vacuum Channel Removed)

FIGURE 4. EXPOSURE FRAME

FIG. 4/ ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
4- 1*	602041-505	•Exposure Frame Assy., Upper, PC-130	1
2*	602041-506	•Exposure Frame Assy., Lower, PC-130	1
3*	601422-003	••Glass, Exposure Frame, with Vacuum Hole, PC-130	1
4*	601465-002 or	••Cover Sheet, MYLAR, Unembossed, 0.2 mm (7 mil), 860 mm x 9.2 m (34 in. x 30 ft.) Roll	1
–*	601465-003 or	••Cover Sheet, MYLAR, Embossed, 0.1 mm (4 mil) 900 mm x 9.2 m (35 7/16 in. x 30 ft.) Roll	1
–*	601465-004	••Cover Sheet, MYLAR, Unembossed, 0.1 mm (4 mil), 860 mm x 9.2 m (34 in. x 30 ft.) Roll	1
5*	601473-001	••Seal, Vacuum Frame, Rubber, 3.2 m long	1
6*	601877-001	••Cup, Vacuum with Plastic Mounting Block and Fitting	1
7*	602895-001	••Vacuum Restrictor (On Frame Glass)	1
8*	601862-502	••Cover Sheet Retainer Assy.	1
9*	601862-001	••Tape, Sponge, 1/2-in.wide, 36-yd. roll (Used with Item 8)	1
10*	602764-002	••Vacuum Channel	1
11*	280762-005	••Tape, Double-Sided, 3/4 in. x 60-yd. Roll (Used with Item 10)	1
12*	601881-001	••Screw, Hex Socket Head, 5 mm x 20 mm	9
13*	280643-003	••Retainer, Glass, Front, with Bump Strip Mount (Top Frame Only)	1
14*	602944-001	••Bump Strip, Rubber (Mounted on Upper Frame)	1
15	280643-004	••Retainer, Glass, Front (Bottom Frame Only)	1
16*	280643-002	••Retainer, Glass, Rear and Side	6
17*	602449-001	••Hinge, Exposure Frame	2
18*	602039-001	••Roller, Grooved, Plastic with Bearing, Frame Transport	4
19*	275773-001	•••Bearing, Frame Transport, ADR No. AX-8-ZZ	4
20*	601864-001	••Arm, Frame Support	2
21*	601880-001	••Bearing, Frame Support Arm, ADR No. AX-6-ZZ	4
22*	602385-001	••Shaft, Bearing, Frame Support Arm	2
23*	601879-002	••Spring, Frame Support	2
24*	601884-001	••Bolt, Support Arm Pivot	2
25*	280645-001	••Washer, Support Arm Pivot (Not Shown)	2
26*	602693-001	••Bracket, Spring Attachment	2
27*	602387-001	••Block, Chain to Frame Attachment	2
28*	602700-505	••Bracket, Roller, Kit (For All 4 Corners)	1
29*	280644-001	••Actuator, Switch, Integrator Circuit Selector (On Upper Frame Only)	1
30*	602886-001	••Actuator, Limit Switch, Upper Exposure Frame	1
31*	602886-002	••Actuator, Limit Switch, Lower Exposure Frame	1
32*	601855-005	••Brush, Upper Frame Seal (Mounted on Lower Frame)	1
33*	601855-006	•Brush, Lower Frame Seal (Mounted on Cabinet)	1

*Stocked Part

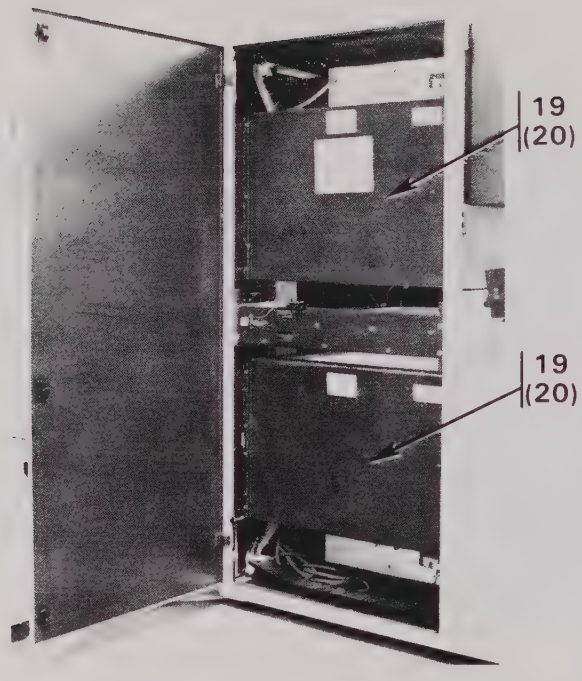


Figure 5a. Printer Cabinet

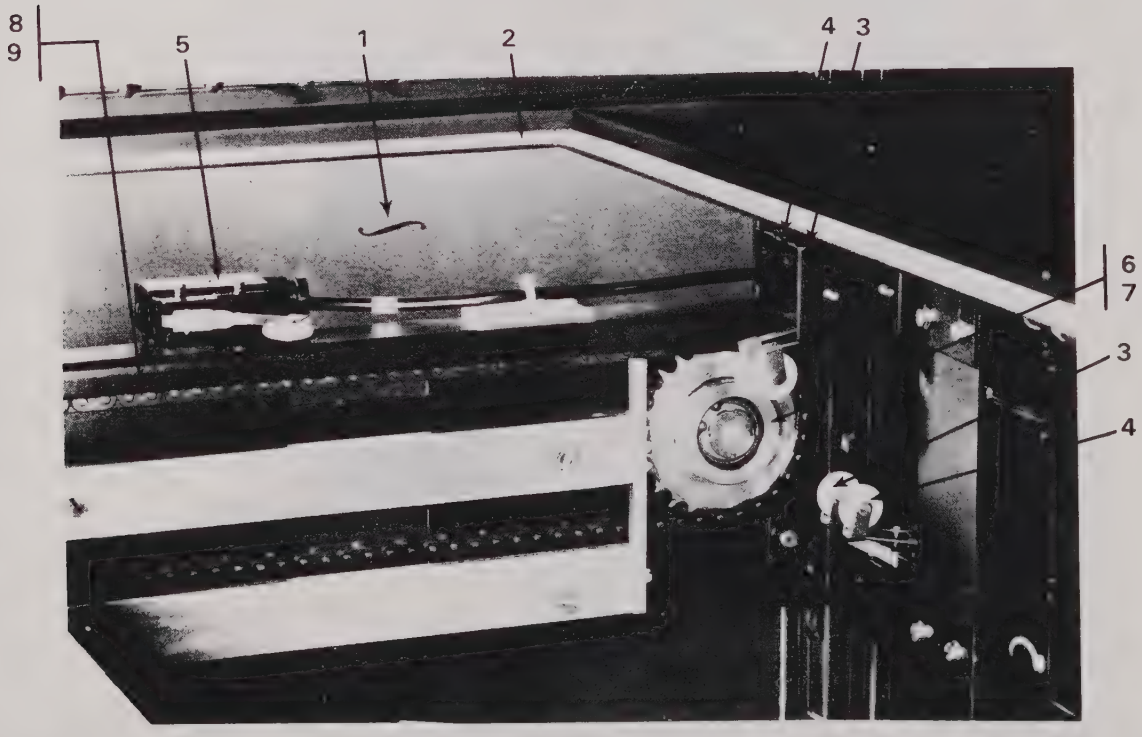


Figure 5b. Printer Cabinet

Figure 5c. Printer Cabinet (Shutter Connector)

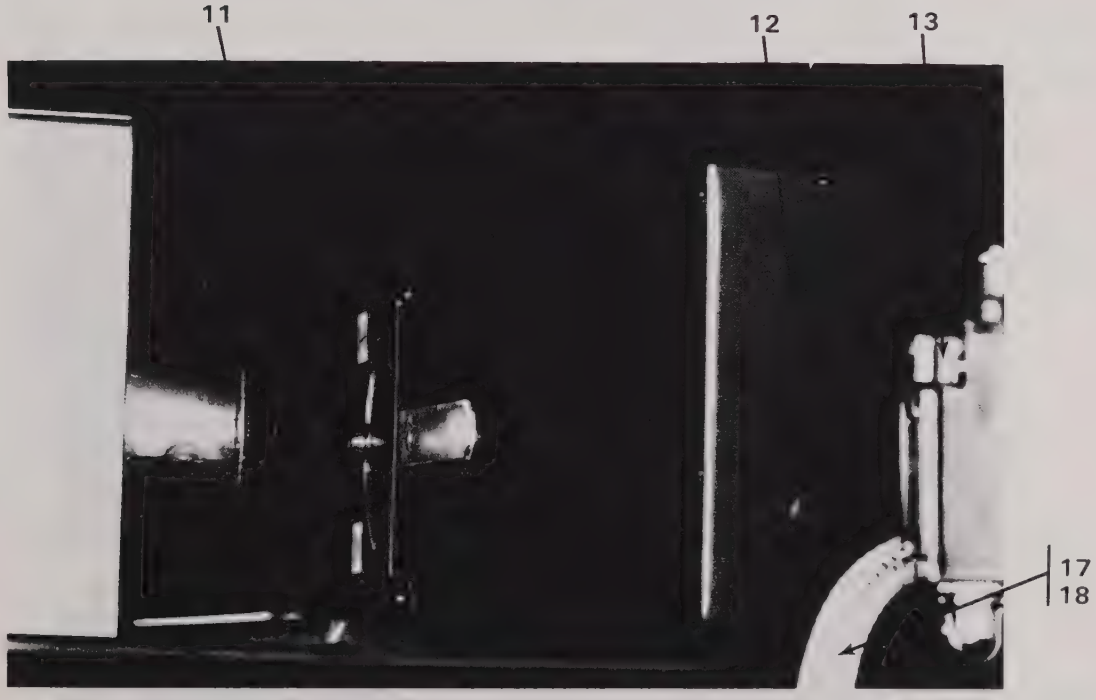


Figure 5d. Printer Cabinet (Lamp Air Duct)

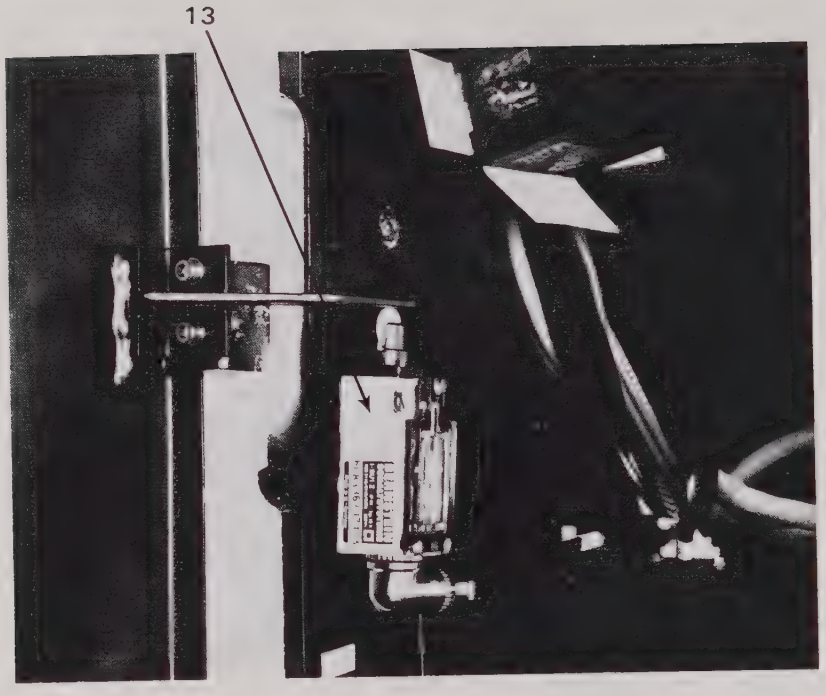


Figure 5e. Printer Cabinet (Door Interlock)

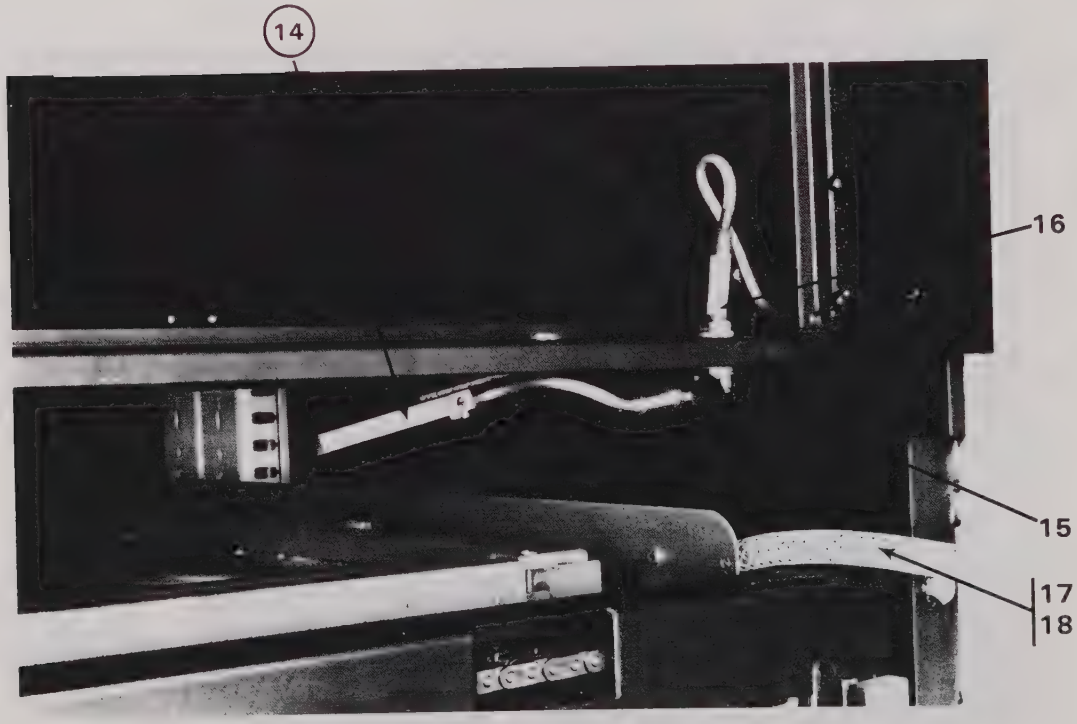


Figure 5f. Printer Cabinet (Photodetector)

FIGURE 5. PRINTER CABINET

FIG. 5/ ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
5- 1*	601423-003	•Glass, Heat Protection	2
2*	602890-001	•Support, Rubber, Heat Protection Glass, 5.6 meters	2
3*	601429-002	•Switch, Limit, Exposure Frame [Vacuum Solenoid]	2
4*	601429-002	•Switch, Limit, Exposure Frame [Exposure Start]	2
5*	601429-002	•Switch, Limit, Exposure Frame [Integrator Circuit Selector]	1
6*	602038-001	•Sprocket, Exposure Frame Transport	4
7*	280006-001	••Bearing, Sprocket	1
8*	280128-001	•Chain, Exposure Frame Transport	2
9*	280128-002	••Link, Connecting (w/tab)	1
10*	602356-001	•Connector, Shutter Cable, 90°, Male & Female	2
11*	602902-001	•Bellows, Rubber, Lamp Housing	2
12*	602888-001	•Plug, Hole, Lamp Air Temperature	2
13*	280948-001	•Switch, Side Door Interlock (S/N 477 & Up)	2
14*	602883-501	•Detector Assy., Exposure	2
15*	602884-001	••Plug, Exposure Detector	1
16*	602885-001	•Receptacle, Exposure Detector	2
17*	601878-002	•Hose, Vacuum, Reinforced, 8 mm ID x 3 mm Wall x 15 m lg.	A/R
18*	602887-001	•Connector, Vacuum Hose Splicing (Not Shown)	A/R
19	603034-001	•Door, Inner Access, Left Side	2
20	603034-002	•Door, Inner Access, Right Side	2
21	602691-001	••Latch, Access Door (Used on Items 19 & 20)	4

*Stocked Part

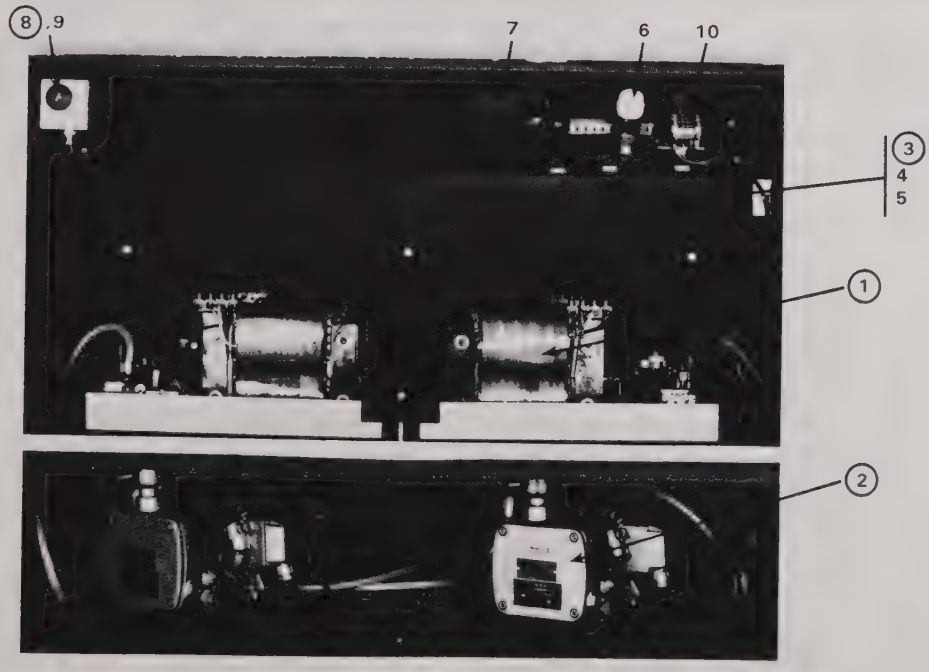


Figure 6a. Lamp Power Supply and Vacuum Pump Compartments

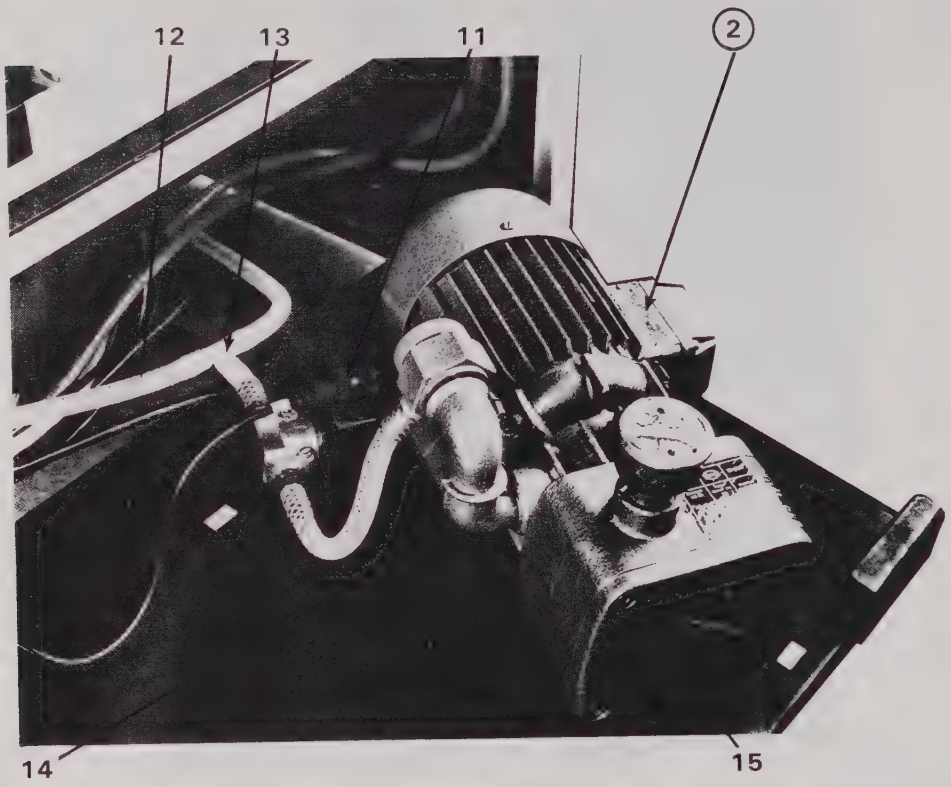


Figure 6b. Vacuum Pump Compartment (Service Tray Pulled Out)

FIGURE 6. LAMP POWER SUPPLIES AND VACUUM PUMP COMPARTMENTS

FIG. 6/ ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
6- 1		•Lamp Power Supply Assy. (See Fig. 7 for Breakdown)	2
2*	601457-001	•Pump, Vacuum, 380V, 50/60 Hz (See Fig. 10 for Breakdown)	2
3*	601417-001	•Fan Tangential, Exposure Frame Cooling	1
4*	602358-001	••Motor, Frame Cooling Fan	1
5*	280927-001	••Bearing, Ball, Fafnir 39KDD	2
6*	601899-001	•Capacitor, 6 MFD, 400 VAC, Frame Cooling Fan	1
7*	601418-001	•Speed Controller, Frame Cooling Fan	1
8*	280949-001	•Switch, Side Door Interlock Bypass (w/key) (S/N 477 & Up)	1
9*	281036-001	••Key, Interlock Bypass Switch	1
10*	601886-001	•Terminal Block, Weidmuller SAK 4	4
11*	601458-001	•Valve, Solenoid, Vacuum, 50/60 Hz	2
12*	601878-002	•Hose, Vacuum, Reinforced, 8 mm ID x 3 mm Wall x 15 meters lg.	A/R
13*	280942-004	•Tee, Barbed, Vacuum Hose	2
14*	280523-001	•Mount, Rubber (Under Vacuum Pump Motors)	8
15*	280524-001	•Support, Rubber (Under Vacuum Pump Oil Sumps)	2

*Stocked Part

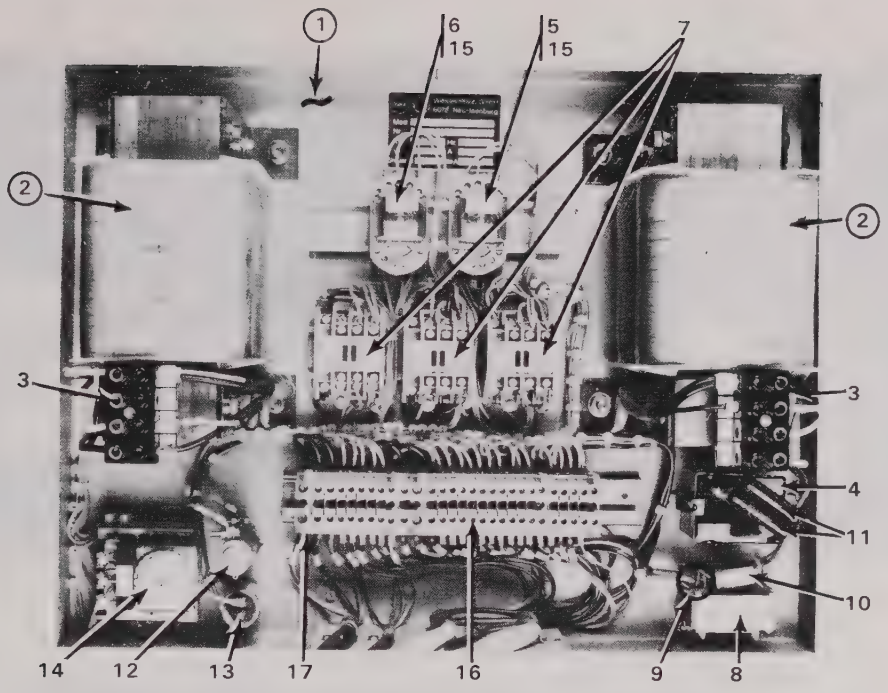


FIGURE 7. LAMP POWER SUPPLY ASSEMBLY

FIG. 7/ ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
7- 1*	601446-002	●Lamp Power Supply Assy., PC-130, 50/60 Hz	2
2*	601447-001	●●Choke, Exposure Lamp [L1, L2]	2
3	280538-001	●●●Terminal Block, Lamp Choke, Kulka Elec. No. 9-85-0-4	1
4*	601449-001	●●Ignition Device	1
5*	601450-002	●●Relay, 24 VDC [Ignition Sensing, K6]	1
6*	601439-001	●●Relay, 220 VAC, 50/60 Hz [Lamp Warm-Up, K7]	1
7*	601453-002	●●Relay, 220 VAC, 50/60 Hz [K1, K3, K4] (S/N 611 & Lower)	3
–*	601453-004	●●Relay, 220 VAC, 50/60 Hz [K1, K3, K4] (S/N 612 & Up)	3
8*	601451-001	●●Transformer [Ignition Sensing, T2]	1
9*	601894-001	●●Diode, 1N 5062 [On T2]	1
10*	601890-001	●●Capacitor, 16 MFD, 350V	1
11*	601889-001	●●Resistor, 3.3 K, 15 W (Two 1.5 K actual)	2
12*	601891-001	●●Resistor, 1.5 K, 24 W	1
13*	601892-001	●●Capacitor, 1 MFD, 450 VAC	1
14*	601454-001	●●Relay, Timer, 0-300 Sec., 60 Hz [Lamp Warm-Up Delay, K2]	1
–*	601454-002	●●Relay, Timer, 0-300 Sec., 50 Hz [Lamp Warm-Up Delay, K2]	1
–*	601454-005	●●Relay, Timer, 0.25-640 Min., 50/60 Hz (S/N 502 & Up)	1
15	280943-001	●●Base, Relay, Plug-In	2
16	601886-001	●●Terminal Block, Weidmuller SAK 4	13
17	280591-003	●●Terminal Block, Ground, Weidmuller EK 4	

*Stocked Part

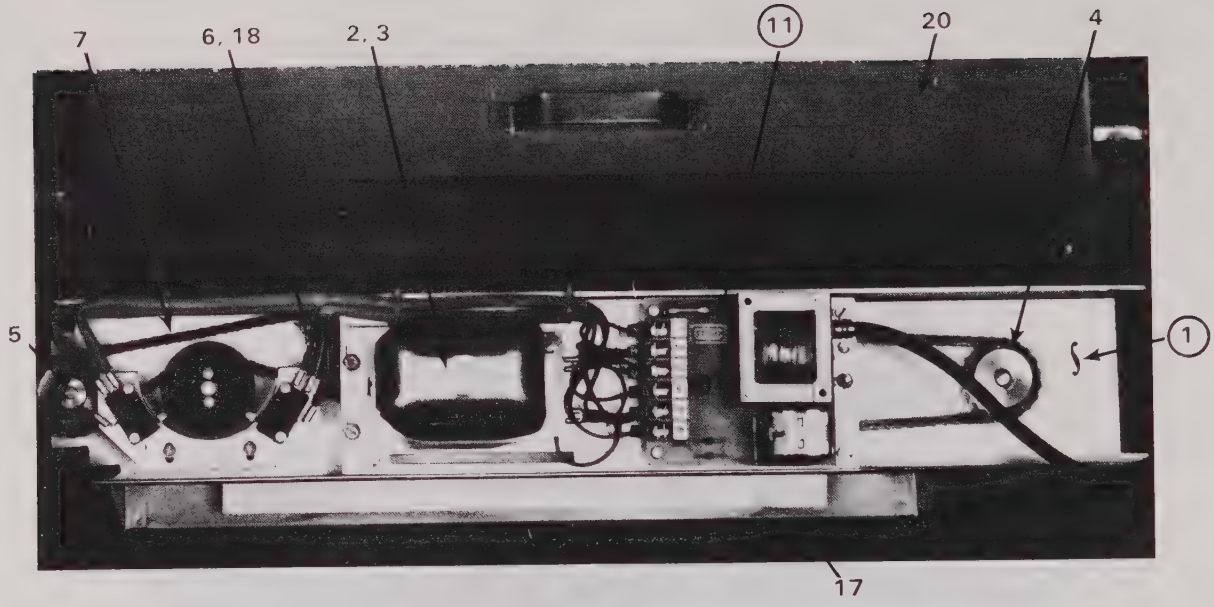


Figure 8a. Shutter Assembly

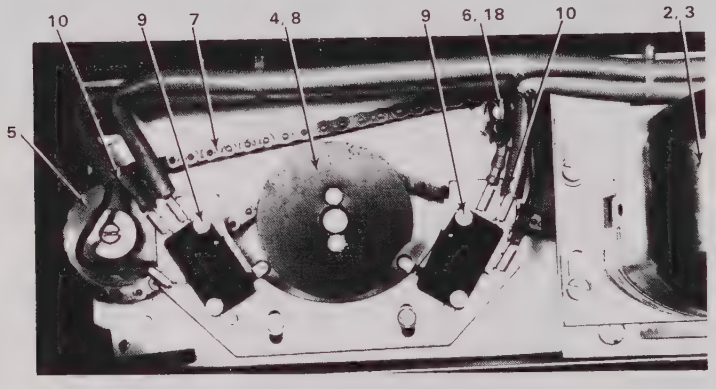


Figure 8b. Shutter Assembly (Left Side)

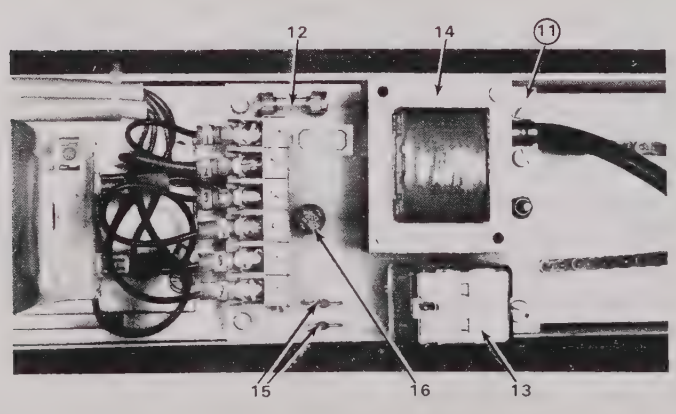


Figure 8c. Shutter Assembly (PC Board Assy.)

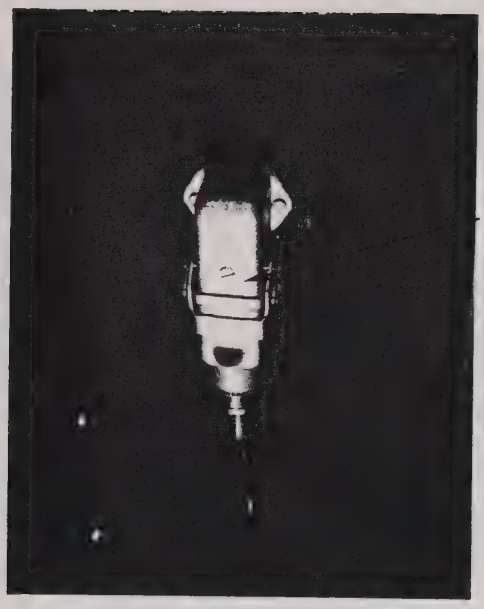


Figure 8d. Shutter Assembly (Power Connector)

FIGURE 8. SHUTTER ASSEMBLY

FIG. 8/ ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
8- 1*	601434-502	•Shutter Assy., Complete, PC-130	2
2*	601435-001	••Motor, Shutter Drive, 12 VDC	1
3*	601469-001	••Sprocket, Shutter Motor (Not Shown)	1
4*	601861-001	••Sprocket, Shutter Door Drive	2
5*	601470-001	••Sprocket, Idler, Large	1
6*	602776-001	••Sprocket, Idler, 8-Tooth	1
7*	280127-001	••Chain, Shutter Drive (w/ connecting link)	1
8*	601859-002	••Cam, Shutter	1
9*	601436-002	••Microswitch, Roller, Shutter	2
10*	601894-001	••Diode, 1N 5062 [V2, V3] (Not Shown — Inside Insulation)	2
11*	601474-502	••PC Board Assy., Shutter Drive	1
12*	601471-001	•••Fuse, 1-1/4 Amp	1
13*	601432-001	•••Relay, PC Board [K5]	1
14*	601858-001	•••Transformer, PC Board	1
15*	601894-001	•••Diode, 1N 5062 [V4, V5]	2
16*	281028-001	•••Bridge Rectifier, Motorola Type MDA 204	1
17*	280114-001	••Doors, Shutter (One Pair)	1
18*	603036-001	••Shaft, Idler (8-Tooth Idler Sprocket)	1
19*	602356-001	••Connector, Electrical, Shutter Cable, 90°, Male & Female	1
20*		•Lamp Housing Assy. (See Fig. 9 for Breakdown)	2

*Stocked Part

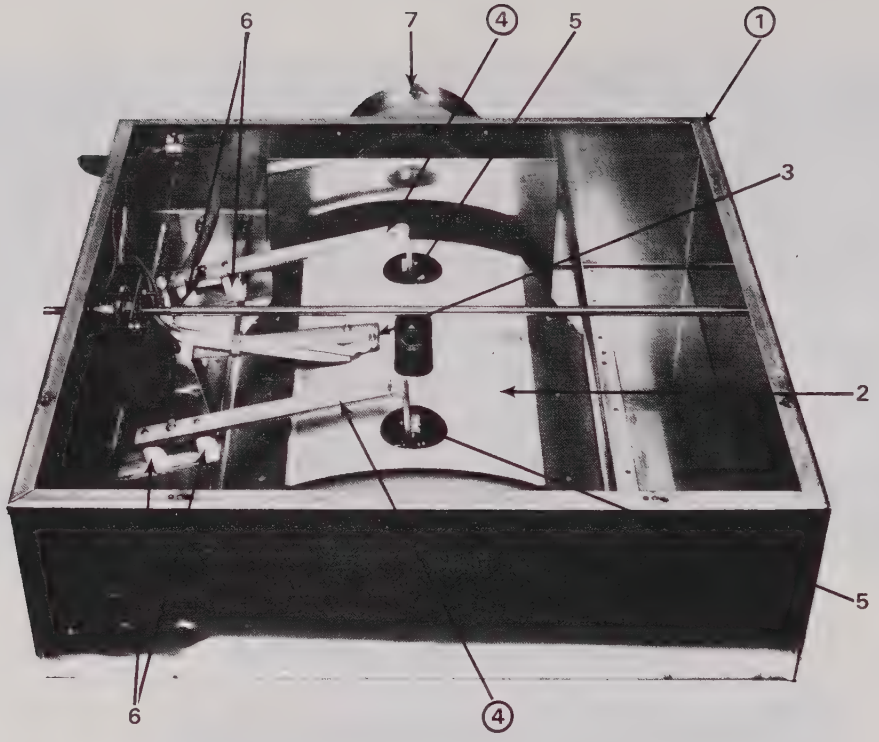


Figure 9a. Lamp Housing Assembly (Cover Removed)
Serial Nos. 611 & Lower

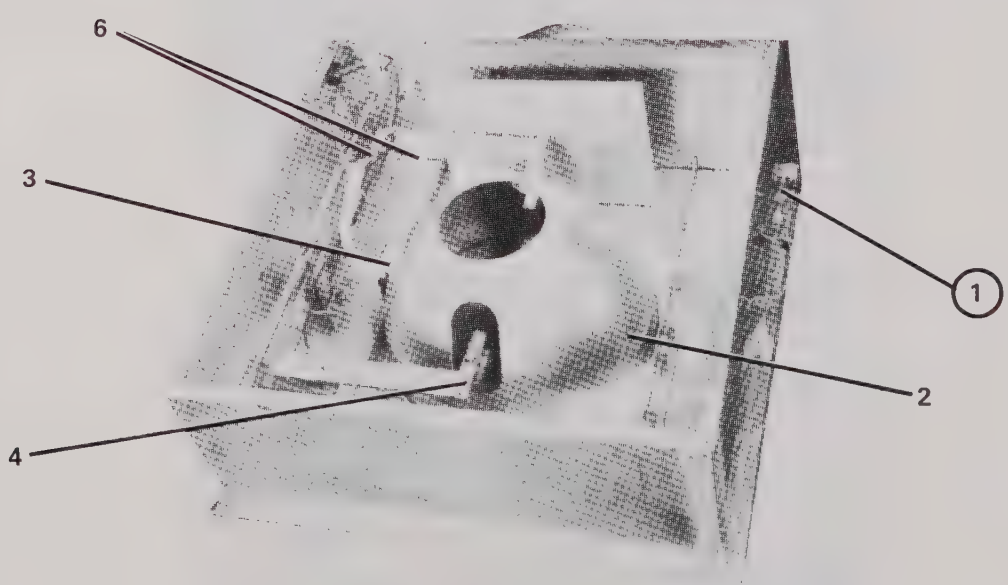


Figure 9b. Lamp Housing Assembly (Cover Removed)
Serial Nos. 612 & Up

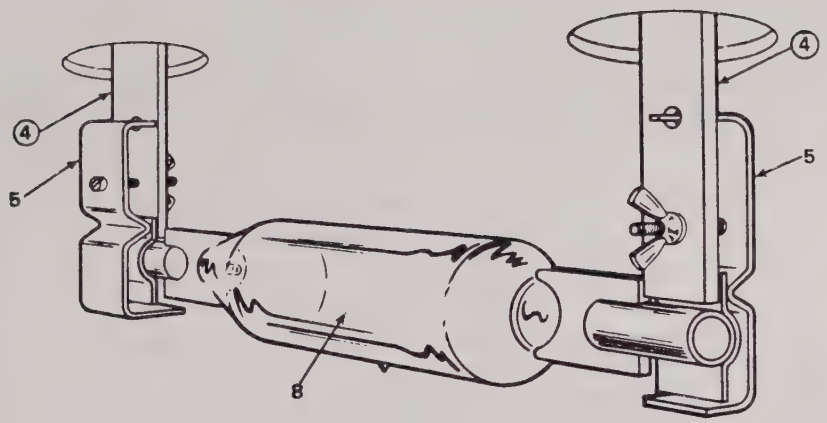


Figure 9c. Lamp Housing Assembly — Lamp Mounting
Serial Nos. 611 & Lower

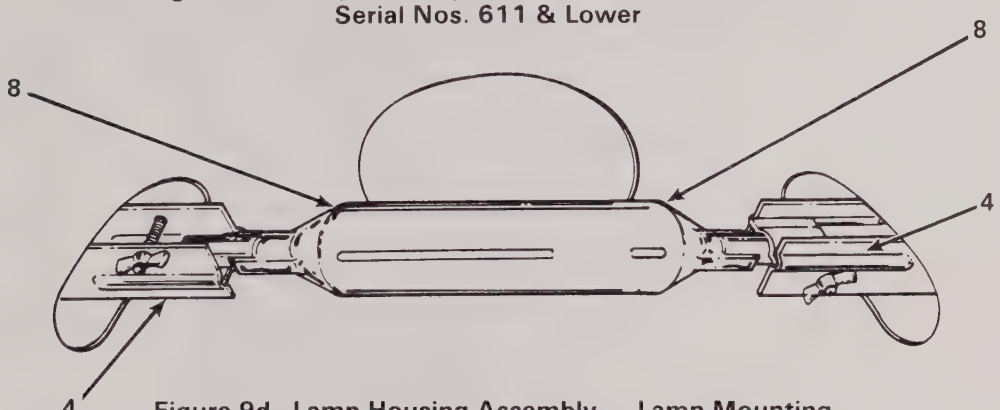


Figure 9d. Lamp Housing Assembly — Lamp Mounting
Serial Nos. 612 & Up

FIGURE 9. EXPOSURE LAMP HOUSING

FIG. ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
9- 1*	601444-503	•Lamp Housing Assy. — Less Lamp (S/N 611 & Lower)	2
—*	601444-505	•Lamp Housing Assy. — Less Lamp (S/N 612 & Up)	2
2*	601883-002	••Reflector, Exposure Lamp (S/N 611 & Lower)	1
—*	601883-003	••Reflector, Exposure Lamp (S/N 612 & Up)	1
3*	602901-001	••Thermoswitch [Overtemp. protection] (S/N 611 & Lower)	1
—*	602901-002	••Thermoswitch [Overtemp. protection] (S/N 612 & Up)	1
4*	602897-502	••Bracket Assy., Lamp Mounting (1 Pair) (S/N 612 & Up)	1
—*	602897-501	••Bracket Assy., Lamp Mounting (1 Side) (S/N 611 & Lower)	2
5*	602898-001	•••Clamp, Lamp Mounting (S/N 611 & Lower only)	1
6*	275560-001	••Spacer, Ceramic, Lamp Bracket (All)	4
7*	602902-001	•Bellows, Rubber, Lamp Housing to Exhaust Duct (All)	2
→ 8*	601443-003	•Lamp Exposure, MO 61 (All — Orig. Equip. Type)	2
—*	~~601443-002~~	•Lamp, Exposure, WO 33 (All — U.S.A. Replacement Type)	2

*Stocked Part

Not Recommended

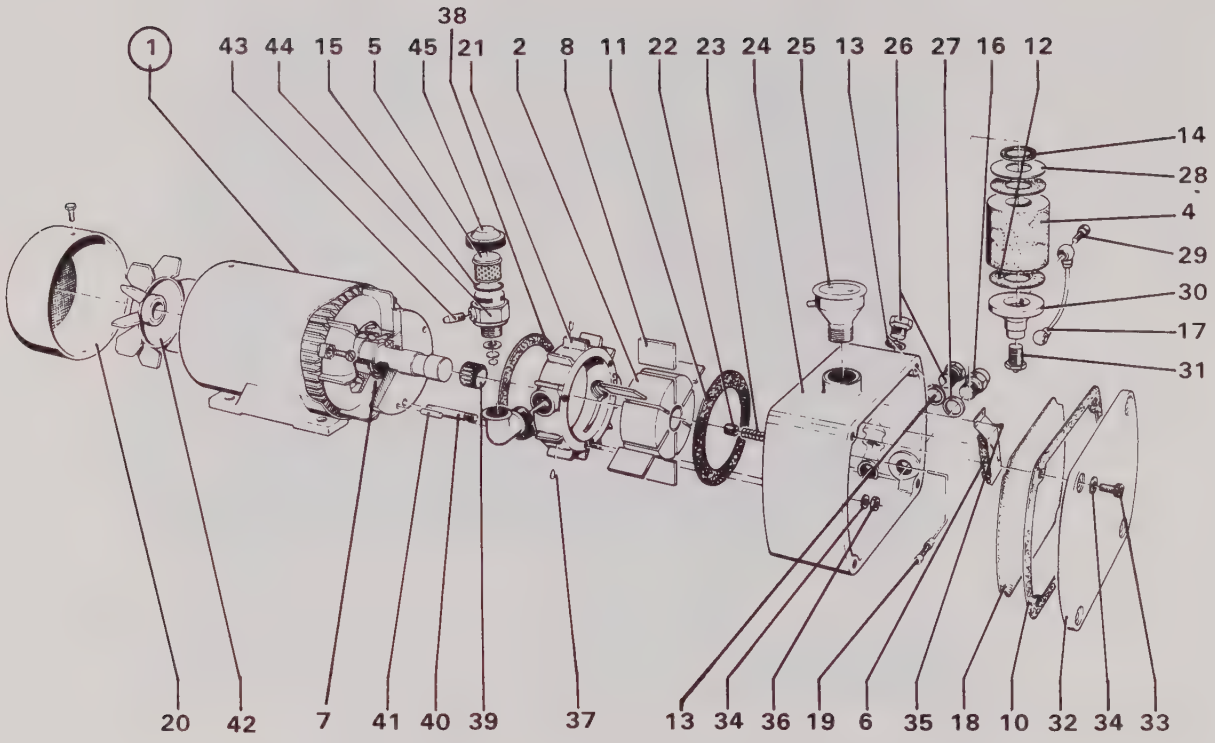


FIGURE 10. VACUUM PUMP ASSEMBLY

FIG. 10/ ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
10-1*	601457-001	•Vacuum Pump, 50/60 Hz, 380V, Becker U6S (See Fig. 6 for Related Parts)	2
2*	602306-001	••Rotor, Becker 02000068	1
3*	602260-501	••Kit, Overhaul	2
4*	601463-001	•••Cartridge, Oil Separator, Becker 904009	1
5*	601464-001	•••Filter, Paper, Becker 84040305	1
6*	601860-001	•••Filter, Metal Sponge, Becker 00600068	1
7*	280113-001	•••Seal, Shaft	1
8*	602108-001	•••Kit, Rotor Vanes (Six) Becker 901218	1
9*	601944-501	•••Kit, Gasket	1
10*	601857-001	••••Gasket, Face Plate, Becker 00700068	1
11	280646-001	••••Gasket, Pump Housing, Becker 00320168	2
12*	601943-001	••••Seal, Oil Separator, Becker 01580068	2
13*	602110-001	••••Washer, Crush, Oil Fill & Drain, Becker 948042	2
14*	280647-001	••••Washer, Rubber, Oil Separator, Becker 01900068	1
15	280648-001	••••Seal, Paper Filter, Becker 84030305	1
16*	280649-001	••Sight Glass, Oil Level, Becker 52090019	1
17*	280139-001	••Oil Return Line, Becker 01190068	1

FIGURE 10. VACUUM PUMP ASSEMBLY (CONT'D.)

FIG. 10/ ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
18*	280650-001	●●Screen, Face Plate, Becker 00800068	1
19*	280139-002	●●Oil Suction Line, Becker 01150068	1
20	280651-001	●●Housing, Fan	1
21		●●Casing, Becker 00010068	1
22		●●Fixing Screw, Becker 06270068	1
23		●●Fixing Rubber, Becker 06280068	1
24		●●Sump, Oil, Becker 00160068	1
25		●●Muffler, Exhaust, Becker 73980068	1
26		●●Plug, Oil Fill & Drain, Becker 00920219	2
27		●●Ring, Sealing, Oil Sight Glass, Becker 948008	1
28		●●Disk, Metal, Becker 06290068	1
29		●●Screw, Hollow, Oil Return Pipe, Becker 00940019	1
30		●●Plate, Pressure, Becker 06300068	1
31		●●Screw, Oil Separator Fastening, Becker 06310068	1
32		●●Cover, Oil Sump, Becker 00170068	1
33		●●Screw, Hex Socket Head, M6 x 12, Becker 945318	4
34		●●Washer, A6 x 10, Becker 948002	7
35		●●Screw, Sponge Filter, Becker 946308	2
36		●●Nut, Hex, M6, Becker 947104	3
37		●●Screw, Recessed Head, M4 x 4, Becker 945605	
38		●●Seal, Housing, Becker 00320068	1
39		●●Ring, Star-Tolerance, Becker 911002	1
40		●●Stud, M6 x 62, Becker 946907	3
41		●●Pin, 4m6 x 16, Becker 947611	1
42		●●Fan, Motor	1
43		●●Fitting, Hose, Becker 73920101	1
44		●●Housing, Filter, Becker 84010405	1
45		●●Cover, Filter Housing, Becker 84020305	1

*Stocked Part

NOTE: See the end of this Parts Section for Becker Co. address.

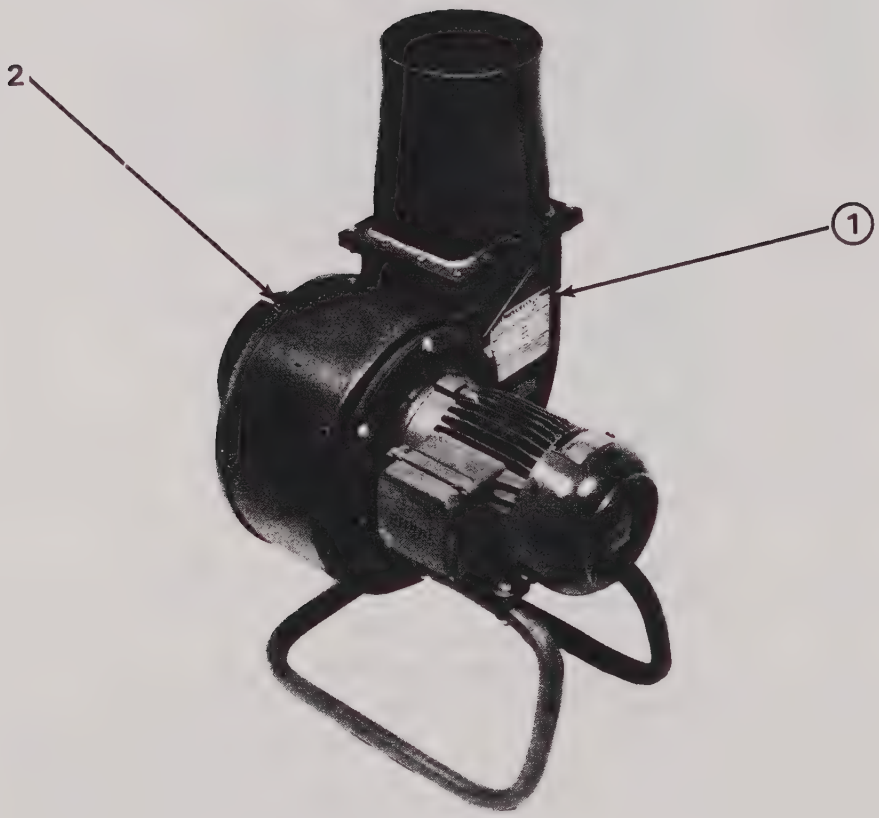


Figure 11. Exhaust Blower

FIG. 11/ ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
11-1*	601706-003	•Blower, Exhaust, Two-Speed, 380V, 60 Hz	1
–	601706-004	•Blower, Exhaust, Two-Speed, 380V, 50 Hz	1
2*	601707-001	••Impeller (Inside Housing, Not Shown)	1

*Stocked Part

Figure 12a. Millijoule Integrator

Figure 12b. Millijoule Integrator Detector

Figure 12. Millijoule Integration System (Optional)

FIG. ITEM NO.	U.S.A. NO.	DESCRIPTION	QTY.
1	–	Millijoule Integration System, Riston® PC-130, PC-30, & PC-24 Printers (U.S.A. Retrofit Model)	1
2*	602973-502	•Detector, Type II (Used w/millijoule integrators on PC-130)	2
–*	602973-501	•Detector, Type I (Used w/millijoule integrators on PC-24 & 30)	2
3*	601438-006	•Integrator, Millijoule Readout (All PC-Printers – Type I or II Detector required)	2
4*	280027-010	••Fuse, Dual Element, Slo-Blo, 0.25 amp, 250V, Bussman MDL 1/4	2
5	281030-001	••Switch, Pushbutton, C & K #8121-J81 [Start]	1
6	281031-001	••Switch, Rocker, C & K #7101-J51ZQ [On-Off]	1
7	281032-001	••Switch, Binary Rotary, Shadow #RTA-2-P-1-5-13-2-11 [Number Selector]	4
8	281033-001	••Knob, Rotary Switch, Alco #KPN-500B-1/4	4

*Stocked Part

ACCESSORIES – NON-ILLUSTRATED

U.S.A. NO.	DESCRIPTION	QTY.
280137-001*	•Cord, Patch, Shutter (Extension Cord for Shutter Servicing)	1
602975-001*	•Manual, Instruction, PC-130 (This Manual)	1
604798-501*	•Kit, Gas Spring Mounting, Exposure Frame (Replaces frame coil springs with gas struts – Fits TC-130, PC-30, & PC-24.)	2
604797-001	••Bracket, Gas Spring Mounting	2
281104-002*	••Spring, Gas, 100 mm Stroke, 20 Lb. Force, Gas Spring Corp. FA77-PI-20	2
281105-003*	••Ball Stud, 10 mm Ball, 5/16 x 18 thread	2
604799-001	••Ball Stud, Modified, 6 mm thread	2
281104-005*	••Clip, Safety, Gas Spring Corp. #A9002	2

*Stocked Part

RECOMMENDED SPARE PARTS

To insure minimum downtime for PC-130 Printer repairs, we recommend that the customer stock the following spare parts. For your convenience, the parts are divided into three categories described below.

Group 1 — Critical Items: These parts are normally expendable or have a high probability of damage or failure. Failure of these parts will shut down the Printer. This is the **minimum** stocking level recommended for domestic customers.

Group 2 — Critical Items: These parts have a lower probability of failure in a well-maintained Printer, but their failure will also shut down the Printer. Group 2 items, together with Group 1 items, are the **minimum** recommended stocking level for **export** customers, as well as for domestic customers who want to ensure minimum downtime.

Group 3 — Convenience Items: These parts will not affect Printer operation but will facilitate operation and service.

FIG./ ITEM NO.	DU PONT PART NO.	DESCRIPTION	QTY.
		GROUP 1 — CRITICAL ITEMS	
9-8	601443-003	Lamp, Exposure, MO-61	2
3-16	602894-001	Fuse, 25 amp (Control Panel)	4
2-17	275770-005	Fuse, 2/10 amp (Orig. Equip. Integrator)	4
2-18	275770-014	Fuse, 2 amp (Orig. Equip. Integrator)	4
3-21	601430-001	Fuse, 6.3 amp (Control Panel)	2
3-20	275770-016	Fuse, 4.0 amp (Control Panel)	12
3-19	275770-014	Fuse, 2.0 amp (Control Panel)	2
3-18	275770-001	Fuse, 1.0 amp (Control Panel)	2
8-12	601471-001	Fuse, 1-1/4 amp (Shutter PC Board)	2
4-4	601465-002	Cover Sheet, 7-mil Unembossed, 10 yd. roll	1
	or		
4-4	601465-003	Cover Sheet, 4-mil Embossed, 10 yd. roll	1
	or		
4-4	601465-004	Cover Sheet, 4-mil Unembossed, 10 yd. roll	1
4-5	601473-001	Seal, Vacuum Frame *	2
10-4	601463-001	Cartridge, Oil Separator (Vacuum Pump) *	4
10-5	601464-001	Filter, Paper (Vacuum Pump) *	2
10-9	601944-501	Kit, Gasket (Vacuum Pump) *	2
		GROUP 2 — CRITICAL ITEMS	
5-14	602883-501	Exposure Detector Assy. (Orig. Equip. Type)	1
3-14	601888-002	Diode 1N 5408 (Control Panel)	3
7-9	601894-001	Diode 1N 5062 (Power Pack & Shutter Assys.)	5
8-10, 15			
10-3	602260-501	Kit, Overhaul, Vacuum Pump	2
3-4	601461-001	Relay, 60 Hz (Exhaust Blower & Vacuum Pumps)	1
3-4	601461-002	Relay, 50 Hz (Exhaust Blower & Vacuum Pumps)	1
3-9	601439-001	Relay (K3, K4, K6, K10 - Control Panel)	1
7-7	601453-002	Relay, 60 Hz (K1, K3, K4 - Power Pack) (S/N 617 & Lower)	1
7-7	601453-003	Relay, 50 Hz (K1, K3, K4 - Power Pack) (S/N 611 & Lower)	1
7-7	601453-004	Relay 50/60 Hz (K1, K3, K4 - Power Pack) (S/N 612 & Up)	1

FIG./ ITEM NO.	DU PONT PART NO.	DESCRIPTION	QTY.
GROUP 2 — CRITICAL ITEMS (Cont'd)			
8-11	601474-502	PC Board Assy., Shutter	1
8-2	601435-001	Motor, Shutter Drive	1
8-9	601436-002	Microswitch, Shutter Cam	2
5-3,4,5	601429-002	Microswitch, Frame Actuated	1
7-5	601450-002	Relay, Ignition Sensing (Power Pack)	1
9-5	602898-001	Clamp, Lamp Mounting (S/N 611 & Lower)	2
9-3	602901-001	Thermoswitch (Exposure Lamp Housing) (S/N 611 & Lower)	1
9-3	602901-002	Thermoswitch (Exposure Lamp Housing) (S/N 612 & Up)	1
9-6	275560-002	Ceramic Spacer, Lamp Bracket	4
6-12	601878-002	Hose, Vacuum, Reinforced (15 meters lg.)	1
GROUP 3 — CONVENIENCE ITEMS			
Acc.	280137-001	Shutter Patch Cord	1
Non-Ill.	601623-001	Key, Access Door	1
6-9	281036-001	Key, Interlock Bypass	1
2-5, 7, 9	601428-001	Bulb, Switch Illuminating	3
2-25	601419-001	Lamp, Fluorescent, 220V (Illuminated Table)	2

COMPONENT VENDORS AND REPAIR SERVICES

The customer can directly contact the following vendors for the goods and services described below; Du Pont will not be involved except as noted.

LIGHT INTENSITY METERS

The International Light Model IL-440 photoresist radiometer used with their XR-140B probe measures light intensity in mW/cm^2 in the wavelengths that affect dry film photoresists. The use of a light meter simplifies balancing frame-to-frame exposure levels and provides the capability of achieving greater exposure accuracy than using density step tablets alone. Your Du Pont RISTON® Products Technical Representative or Equipment Service Representative can provide information on the proper use of light meters with the RISTON® PC-130, PC-24, and PC-30 Printers.

ORDER: Model IL-440 Photoresist Radiometer with Model XR-140B Probe

VENDOR: International Light Inc.
Dexter Industrial Green
Newburyport, Massachusetts 01950
Telephone: (617) 465-5923

LIGHT METER MODIFICATION FOR LIGHT ENERGY

The International Light Model IL-440 photoresist radiometer can be modified to measure millijoules per square centimeter (mJ/cm^2) of light **Energy** as well as its normal function of measuring mW/cm^2 of light Intensity. This modification adds an integration circuit to further simplify the exposure balance procedure on RISTON® PC-Printers.

Two light energy ranges are provided: 0 to 300 mJ/cm^2 for RISTON® photopolymer film resists, and 0 to 1000 mJ/cm^2 for VACREL® dry film solder mask.

Send IL-440 light meters to:

Mechtronics Industries
320-A Turner Lane
West Chester, Pennsylvania 19380
Telephone: (215) 436-9191

NOTE: This modification VOIDS International Light's one-year guarantee on new IL-440 light meters annd they will not repair or recalibrate modified meters. Mechtronics Industries guarantees the modification of the meter for 90 days and will repair and recalibrate modified IL-440 meters.

VENDOR REPAIR SERVICES

Original Equipment Integrators:

Mechtronics Industries
320-A Turner Lane
West Chester, Pennsylvania 19380
Telephone: (215) 436-9191

NOTE: Replacement integrators must be purchased from Du Pont.

Millijoule Readout Integrators:

Electronic Instrumentation and Technology, Inc. (EIT)
1439 Shepard Drive
Sterling, Virginia 22170
Telephone: (703) 450-6660

NOTE: Replacement millijoule readout integrators must be purchased from Du Pont.

Modified IL-440 Photoresist Radiometers (For mJ/cm^2 Measurements:

Mechtronics Industries
320-A Turner Lane
West Chester, Pennsylvania 19380
Telephone: (215) 436-9191

Vacuum Pump Parts and Rebuilding Services:

Parts listed in Figure 10 with no Du Pont number can be ordered directly from Becker Pumps Corp. Vacuum pumps can also be shipped to the vendor for rebuilding.

Contact:

Becker Pumps Corp.
1350 Home Avenue
Akron, Ohio 44310
Telephone: (216) 633-1083
Telex: 98-6360

NUMERICAL INDEX

The numerical index shows the location of a part when only the part number is know. The part numbers are arranged numerically and are followed by the figure and item numbers of the assembly in which they appear.

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VII SAFETY

A. OPERATING SAFETY

1. Disconnect and lock out the power before opening any access panels on the Printer.

   We recommend actually locking out the main power disconnect to prevent others from powering the unit. If this is not possible, tag or tape the main power switch to inform others of the danger.

2. Do not look into the Printer cabinet while the lamps are on. The intense ultraviolet light can cause serious eye damage.

B. MAINTENANCE AND SERVICE SAFETY

1. Unless it is necessary for service, disconnect the power before opening the access panels on the Printer, exhaust blower, or transformer.

   We recommend actually locking out the main power disconnect to the transformer to prevent others from powering the unit. If this is not possible, tag or tape the main power switch on the Printer to inform others of the danger.

2. Wear safety glasses when working on the exposure lamps or the lamp housings.

3. When possible, do not service the interior of the unit with the lamps energized. If it is absolutely necessary to open the Printer with the lamps on, wear suitable protective clothing. Only authorized personnel should have access to the door interlock bypass switch key (S/N 477 & Up).

   a. The intense ultraviolet light can cause serious eye damage.

   b. There is exposed 400 volt electrical wiring in the Printer, transformer, and exhaust blower.

   c. The metal surfaces and exposure lamps in the Printer can be very hot.

4. Wear leather gloves when handling glass panels. The panels' sharp edges can cause serious cuts.